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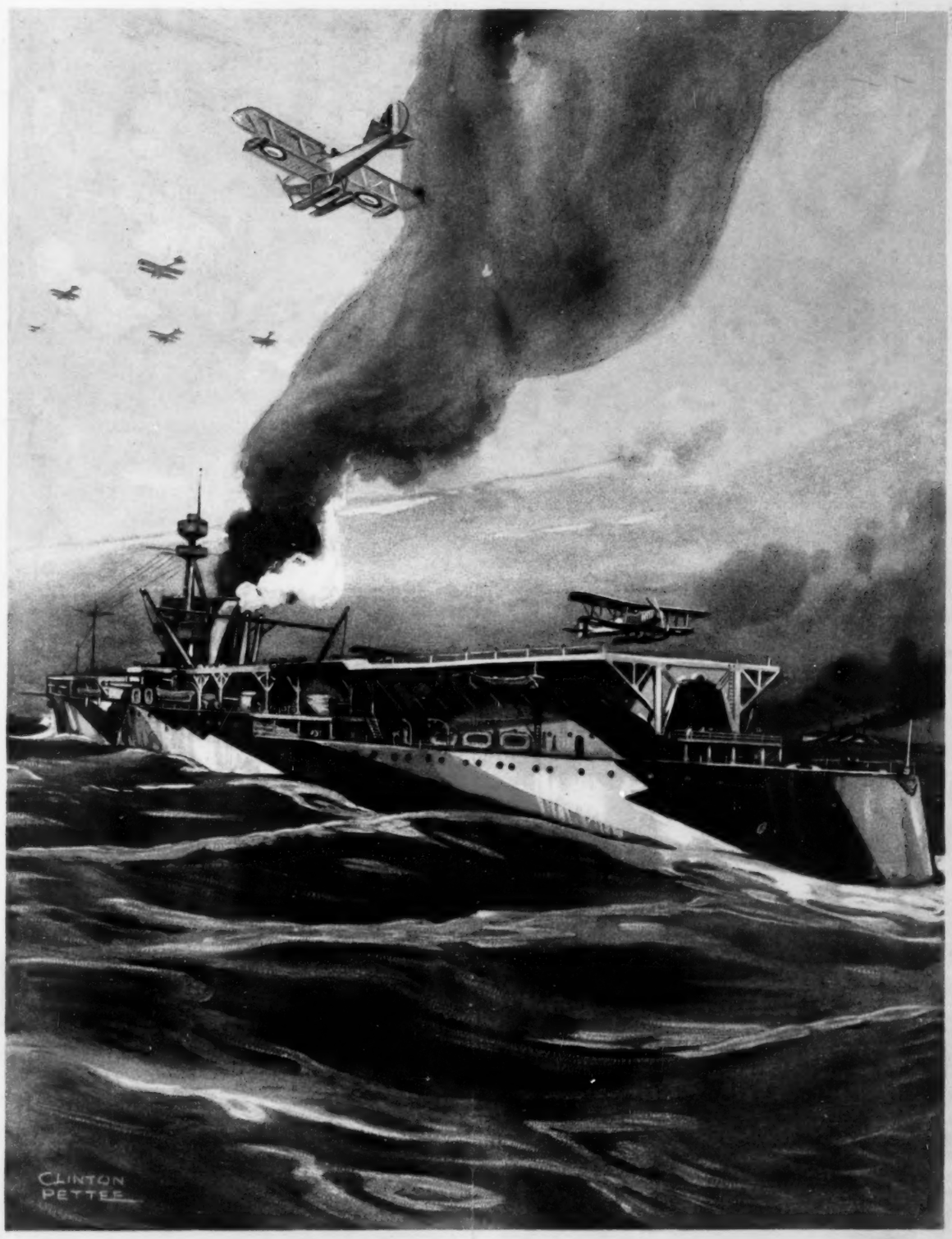

FLOATING BASE FOR BRITISH AIR FORCES IN THE NORTH SEA

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January 4, 1919

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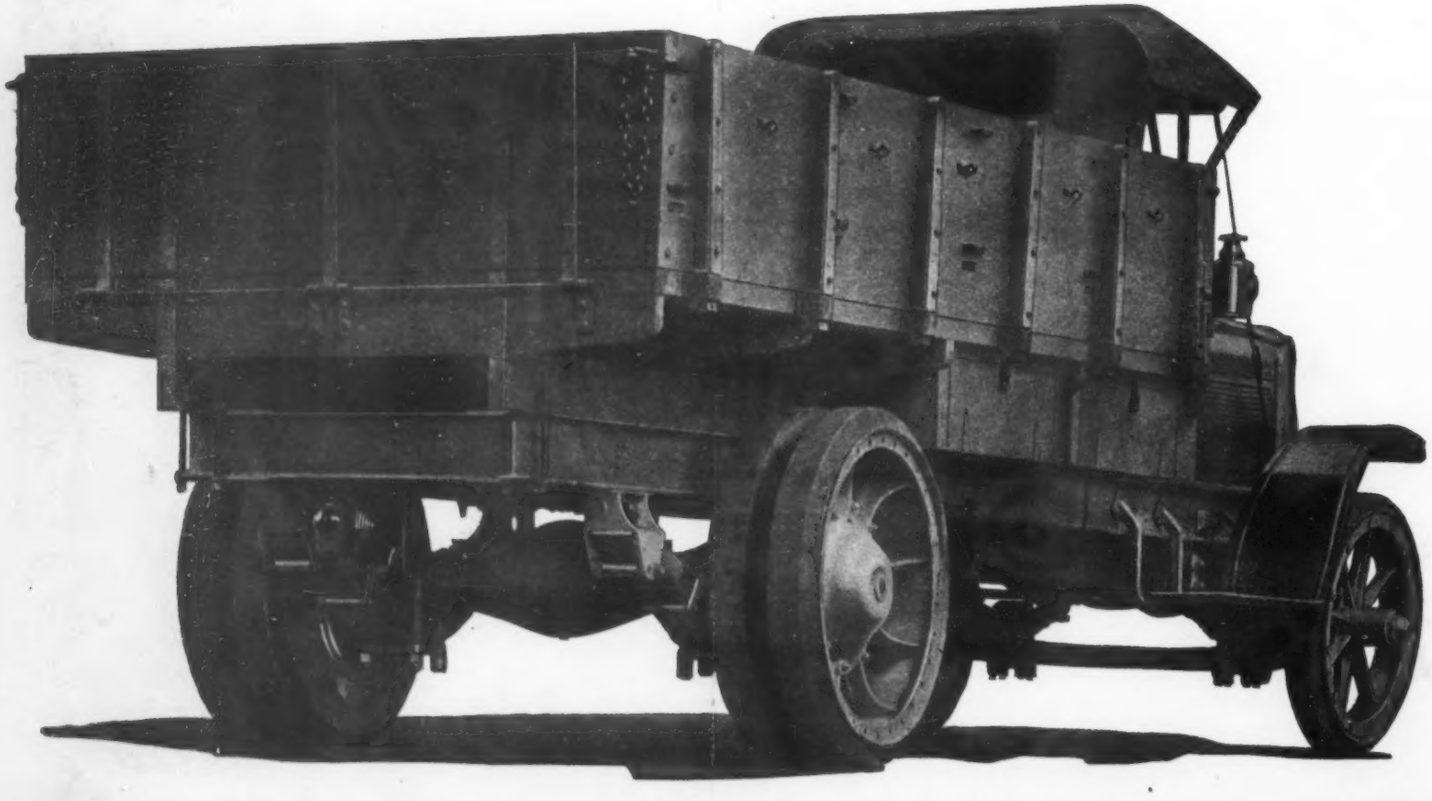

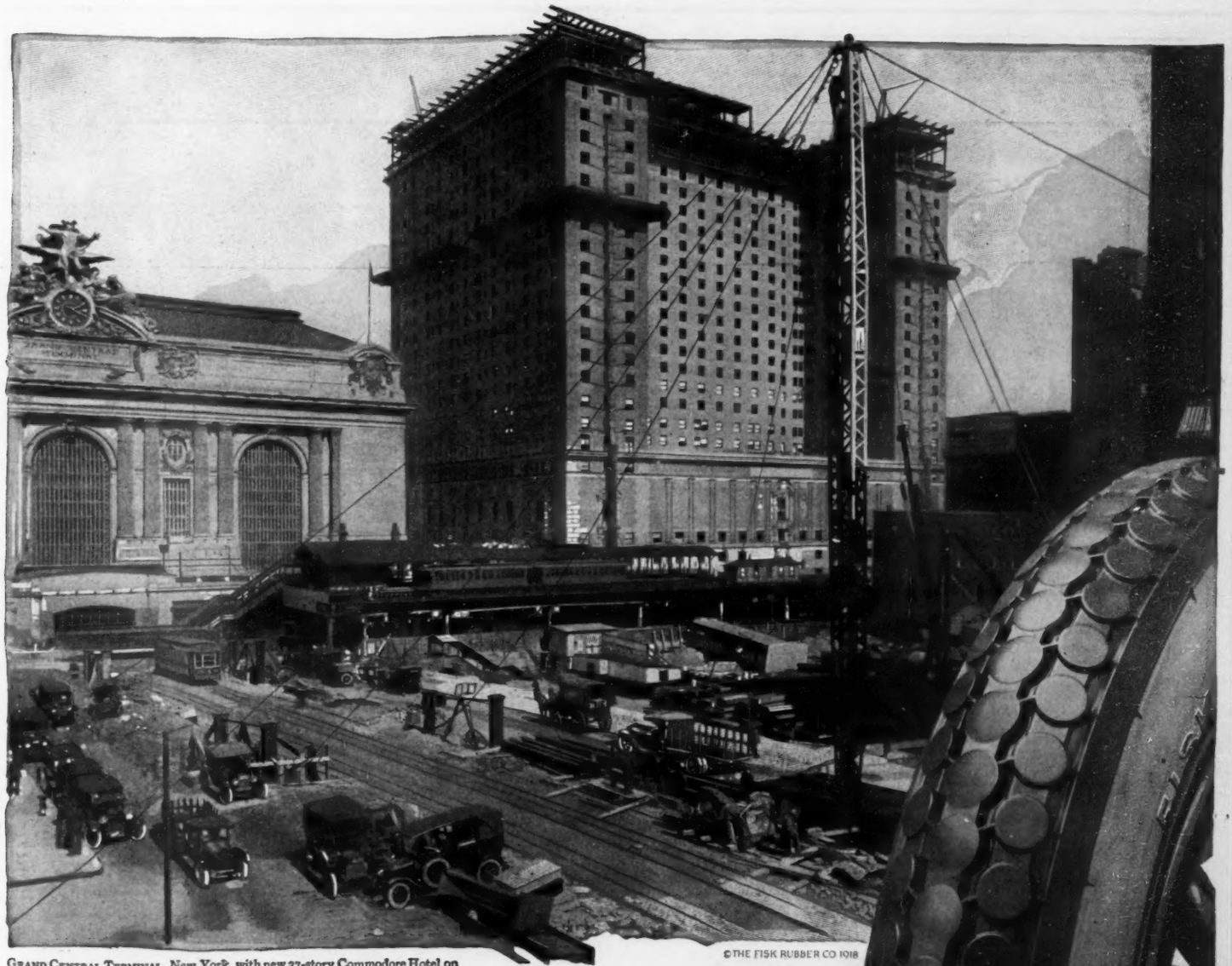

GRAND CENTRAL TERMINAL, New York, with new 27-story Commodore Hotel on right. An average of 502 trains, 86,668 passengers and 50,000 non-passengers enter and leave this great railroad terminal in a single day.

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After the joys and celebrations of peace are forgotten, there remains the stern and difficult task of restoring your factory to a peace basis. Whether the factory has been making hand grenades or pianos, the war has imposed certain restrictions which alter former conditions; and with the advent of peace, new conditions are met. In some cases increased facilities, due to munition work, call for new products to take the place of the abandoned military ones. In others, the old-time products of former peace days, have been worn threadbare, and new ones are necessary. What are you going to make?

To the Inventor:

Your opportunity is at hand. You are being sought today for your ideas. Those patents which were granted you several years ago, and which have lain dormant in the pigeon holes of your desk or in the strong box at home, may now find a ready market if they have reasonable merit. For the increased manufacturing facilities of many American industries, brought about by inflated military production, are now seeking for something to make—something which can keep the wheels turning. The ammunition of today is ideas; and the batteries of lathes, planers, automatic machinery and so on are standing by waiting for you.

TO the end of bringing the manufacturer in touch with the inventor, so that one may obtain the ideas which the other desires to dispose of, the SCIENTIFIC AMERICAN has established a Reconstruction Department. *Under that heading will be published the requests of manufacturers for new ideas, stating their facilities and specific requirements, as well as the offerings of practical inventors. The department is to be a rialto for manufacturers and inventors. It is but another feature which goes to make the SCIENTIFIC AMERICAN "The Journal of Practical Information—and Practical Service."*

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SEVENTY-FIFTH YEAR

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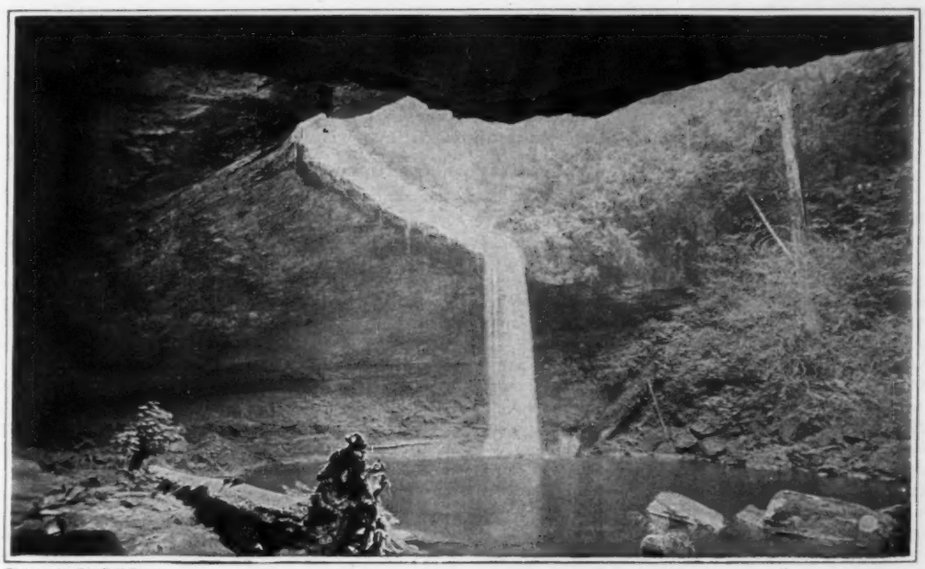
The Coos County Forests

IN Coos County, Oregon, on the western side of the Coast Range Mountains, through a primitive forest of fir and cedar the Lost River wends its way. In one of the most inaccessible parts which only the hardiest of "hikers" have penetrated the river makes a drop of nearly 100 feet. The overhanging bank forms a deep cave before which the water forms a gauzy curtain. The diminuitive spectators in the accompanying photographs give some idea of the height of the falls, and the size of the big cave. The few who have viewed Lost River Falls have seen nature just as the maker designed it. As yet it is untouched by man.

Lost River empties into the East Fork of the Coquille River. This river also forms a cascade of rare beauty—the Cape Horn Falls. Here grows the myrtle tree, a very hardy tree, but one that cannot be transplanted. It furnishes a hard beautifully grained, high-priced wood, used in making nut bowls. The myrtle tree, although plentiful on the west side of the Coast Range is not to be found on the east side.

A still loftier cascade is to be found in the Camas Creek, where there is a drop of 200 feet. "Toe Head Falls," as it is called, is located in the recesses of an almost unknown forest. The photograph shows two timber cruisers on the natural foot log in the foreground. The foot log is formed by a fallen tree which holds in check a mass of floating debris. In this region beautiful fern fronds are to be found as tall as a man and taller.

Despite the hardships of penetrating the primitive forests of Coos County, visitors will be amply repaid for their arduous efforts in the magnificent examples of Nature's handiwork which abound in these wild regions.

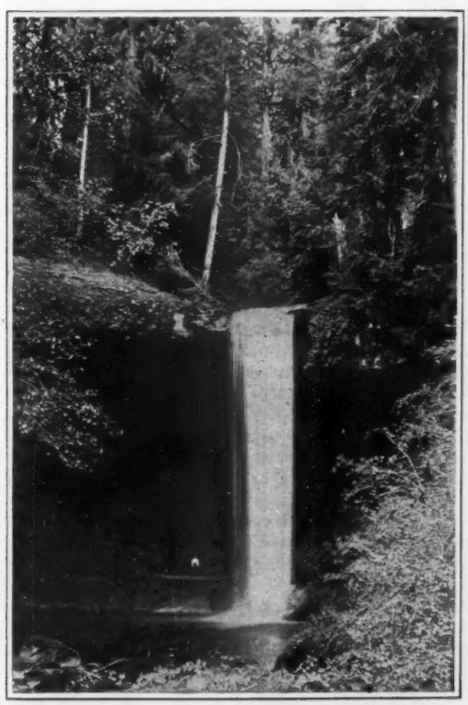


Photographs all by Ruth Fargo

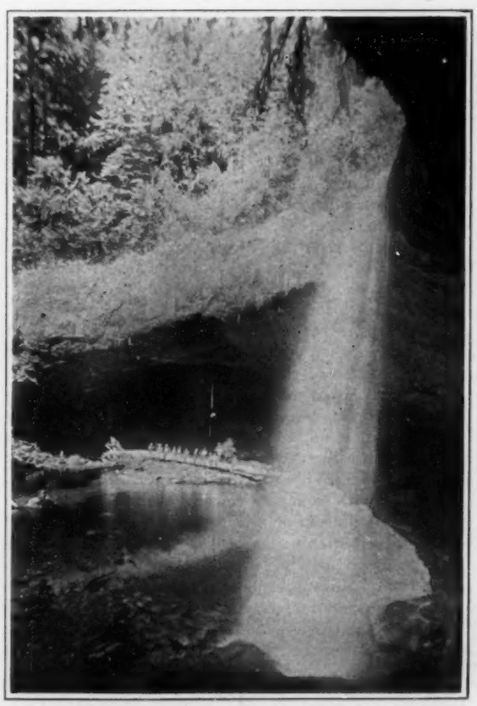
Lost Falls as viewed from the natural cave below

Mt. Katmai Explorations

THE exploration of the Mt. Katmai region, in Alaska, under the auspices of the National Geographic Society, which is likely to be of several years' duration, was carried forward last summer by Messrs. J. Sayre and P. P. Hagelbarger. After a hazardous voyage, they arrived on June 10th at Naknek Lake, and they completed their season's work in August. The topographic survey, begun in 1917, was extended to the shores of Bering Sea, adding about 1,500 square miles to the map and completing a section across the base of the Alaska Peninsula from Katmai Bay to Kaknek Lake. Measurements of the temperature of volcanic vents were made with pyrometers supplied by the Carnegie Geophysical Laboratory, the highest temperature found being 430 deg. Cent.



Where the Lost River makes a drop of nearly a hundred feet



The feathery falls of Lost River. Note the figures on the log below the falls

Toe Head Falls, 200 feet high, in the recesses of an almost unknown forest

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Harmony of the Peace Conference Threatened

WE showed, last week, that the end of the war finds the United States Navy in second position and equal in power to the three next navies combined. This very startling revelation must be borne in mind when considering any plans for future naval expansion.

During the ten years preceding the outbreak of the European war, Congress had been conservative to the point of parsimony in its annual appropriations for the upkeep and increase of the Navy. The dangers of this policy were repeatedly pointed out in these columns, and when the war began, the SCIENTIFIC AMERICAN did what it could to explain the situation and make clear the absolute necessity of bringing the standing of our Navy back to second place. It is quite possible that neither Congress nor our people had appreciated the menace involved in Germany's naval program, which increased with the passing years; even if the German plan of world conquest had been revealed in those days, no one would have believed that it was anything more than an empty dream. But whatever lay back of German naval activity, the fact that our fleet was falling so far behind the German fleet in fighting strength, filled all careful students of the naval situation with deep concern.

In 1916 a vast program of new construction was mapped out and passed by Congress; and although the ships of that program have not been built, owing to other and more imperative naval work demanded by the exigencies of the war, it was an excellent provision and it would have brought us back to the second place. It still remains on our books as an authorized program to be carried out.

But the astounding proposition is now made by the Secretary of the Navy, not only that this program should be completed, but that an additional program, equal in extent, should be approved by Congress. Those who are interested in naval affairs are confounded by such proposals being put forward at this time, and naturally ask the meaning of any such amazing increase of our navy.

The explanation put forth by Secretary Daniels and Admiral Badger, that we need 32 new superdreadnoughts to police the seas in time of peace, is so puerile that it is difficult to take it seriously. Policing is done by gunboats and light cruisers, not by superdreadnoughts.

Moreover, it is evident that the announcement of such an enormous program places the United States in a most inconsistent, if not ridiculous position. Our President has gone before the Allied nations with an olive branch in one hand, a proposal for a League of Nations in the other, and words of peace upon his lips; nevertheless, while our President is thus advocating disarmament and the destruction of militarism, the Secretary of the Navy is calling for an enormous increase in the size of our navy with all the threat of militarism which that implies. The Secretary is in earnest; for he has made speeches advocating this plan on various occasions and in different parts of the country. Meanwhile our Press is discussing the desirability of taking the magnificent German fleet which has been surrendered to the Allies, and sinking it on the high seas, as the simplest method of disposing of what might become a cause of dissension among the Allies; although this assumption of existing jealously among the Allies is gratuitous, unwarranted, and in decidedly bad taste.

We hesitate to believe that Mr. Daniels, who has always been an advocate of peace, has suddenly become a disciple of militarism; but can any other construction be placed on his action? The Secretary of the Navy is no doubt a good Democrat. He is a member of the Cabinet of the Democratic administration which for over half a century has advocated economy in governmental administration. Is Mr. Daniels true to these principles when he brings forward, at this time, a naval program which will add many billions to the public debt?

This proposed fleet must be paid for by the people, and the Secretary calls upon every American citizen to meet his share of an expenditure which is as vast as it is needless. *It would seem that the heavy sums which have been handled in the course of the war have so blunted the money sense of some of our Government officials, that they have forgotten that it is the individual taxpayers of the United States who must carry the burden and pay the price.*

Our President has very definitely announced that the advantages which the United States expects to gain from this war are of a purely moral and spiritual kind. Not the least of these is the sweeping away, once for all, of that long-discredited "whip-creation" spirit, which Mr. Daniels (unconsciously, of course) is fanning into flame by his advocacy of the biggest navy on earth.

The Factory and the Home

A BUCYRUS, Ohio, manufacturer recently brought to that city, by a great effort, 150 employees; after a few days 30 remained, the balance having decamped because they could find no comfortable homes. A prominent public service corporation near Philadelphia confesses to a labor turnover of 1,100 per cent; and while this is exceptional, a figure of 400 per cent is common.

These conditions are widespread. During the past two or three years employers of labor in all our big industrial centers have experienced such difficulty in getting and keeping men that much attention has been focused upon the employment situation. Investigation has shown that one of the prime causes for the shifting population and large turnover of many plants is the utterly inadequate housing accommodations available for the workers.

In years gone by, when wages were low and "labor turnover" meant nothing to the accountant of costs, there was always a long line of men waiting for a job; and because of this excess of supply over demand, a man was not so ready to throw up his job and look for another. He would put up with poor housing conditions for the sake of having any job at all. But today there is no longer the economic pressure upon the worker that forces him to sleep six or eight in a room hardly big enough for two, and to turn out of bed in the morning just in time for the night-shift man to take his place. So as fast as manufacturers bid for his services by putting up decent houses, he is going to leave the old unsanitary crowded quarters and go to the new village where he can live decently with his wife and family.

The manufacturer will do well to bring himself to a realization of the fact that labor, in thus exacting decent living accommodations, is not holding up the community or the employer for something that is not its just due. The laborer is rather in the position of one who has been unable to get what was due him, and who now for the first time is free of that disability. Naturally enough he makes hay while the sun shines, here as well as in the matter of wages, but while wages may go back to a lower level, it is not conceivable that it will ever again be good form to herd workers in the disgraceful manner in which they have been herded in the past.

Indeed, apart from any consideration of this subject on the humanitarian or sentimental side, the industrial employer is beginning to realize the tremendous importance of good living conditions in their relation to production. Many years ago he discovered that it paid to give his workers decent surroundings while at their work; and now he is discovering with equal force that it pays to see that they have a place to live in which a normal human being can take some pleasure in living.

The manufacturer is finding out that men who are housed in unhygienic and unsanitary dwellings are not so healthy, not so efficient, lose more time through sickness, and are more stupid and more troublesome in the plant. Statistics compiled in Chicago and elsewhere show conclusively that the areas having maximum density of population coincide with those having the highest percentage of tuberculosis and other contagious diseases, as well as of crime and social evil. Indeed, it could not be otherwise.

The output of a plant is seriously affected by the prevalence of sickness. With open privies and cesspools in every workman's backyard, and wells within 20 feet of these, typhoid is an ever present danger. With overcrowding and lack of opportunity for personal cleanliness, tuberculosis and other diseases flourish. We know one estimable lady who supports herself in a manufacturing town by taking in lodgers, and who accounts herself fortunate when, as is frequently the case, she secures a roomer who declares that he does not wish to use the bath tub. Her mistaken point of view is well matched with that held by many employers, but, happily, every day by less. We are in fact coming to realize that people who live in pig-sties are likely to be and to act like pigs. If we want respectable and intelligent men and women to work for us, we must see that they have decent, healthy and comfortable homes.

It is for this reason that, more and more, employers are assuming responsibility of some sort in connection with housing accommodations for their workers. This need not always take the form of company-owned cottages or apartments—a form that is often resented, even when coupled with a scheme for ultimate sale to the tenant. It has many weak points to offset its obviously strong ones, and makes the maximum demand for extreme judgment in administration; but in many instances it is the only satisfactory solution. Indeed, in the twentieth century reaction from the nineteenth century idea that every man's life was his own to run and ruin as he pleased so long as he steered clear of actual crime, we are developing a race of people who deal so expertly in human relations that, after all, the dangers of paternalism and the probabilities of any system degenerating into peonage are minimized.

Without hesitation, we say that every large plant located outside the very biggest centers of population should choose between three alternatives. One of these is regulating housing conditions from without, by bringing pressure to bear upon owners and local authorities. The second is similar regulation brought about by actual participation in the business of housing. The third is submission to a high turnover and a low class of workers. For today, unless an employer sees to it that his employees have a respectable place to live in, he cannot get good men or keep any kind of man.

And finally, if the employer does not set his house in order of his own accord, it is up to us to make him do so; for our reconstruction program can be hampered by no factories that are running at half or quarter their rated capacity through ineffective labor conditions. Great Britain has spent $700,000,000 on industrial housing since the war began; with our late entrance we have spent $110,000,000, which is but a tithe of the capital that must eventually go into the improvement of our workers' homes.

Fossils from the Canadian Rockies

A LATE report on the explorations and field-work of the Smithsonian Institution in 1917 records a remarkable collection of fossils made by Secretary and Mrs. Walcott at the now well-known "Burgess Pass fossil quarry," near Field, British Columbia, discovered in 1910. In the course of 50 days' work the party took out a section of the quarry about 180 feet square, thus practically exhausting a site that has yielded the finest and largest series of Middle Cambrian fossils yet discovered, and the finest invertebrate fossils yet found in any formation. More than a ton and a half of specimens were trimmed out at the quarry, wrapped in bundles, carried by pack horses to camp and thence to the railway station at Field, whence they were shipped to Washington. Large blocks of hard shale were first blasted loose, then carefully split with chisel and hammer to expose any fossil remains between the laminæ. The shale has preserved for some twenty million years animals that were as soft and non-resistant as jellyfish, worms, crabs, etc., notwithstanding all the vicissitudes these rocks have since undergone from the time they were simply hardened mud. They have been subjected to much pressure and profound chemical change, but the fossils remain perfect.

Review of the Year 1918

The World War

THE closing months of the year now past witnessed the fall of the curtain upon the most stupendous of all the multiplied human tragedies which have moved across the stage of life since life began.

War, at any time, even when its wounds and sorrows are tempered by forbearance and chivalry, is a dreaded thing, the threat of which, when it lifts its head over the verge of the world, makes the cheek blanch and the stoutest heart quail. This is true, even when nations which are enriched with the gifts and graces of civilization fight for causes which seem to each contestant to involve the fundamentals of right and morality.

The horror and enormity of this war lie in the fact that it was an avowed attack upon Civilization itself—that the assault was carried on with a cynical and calculated disregard of every consideration of chivalry and mercy—and that, if it had won out, all the world's cherished and hardly won ideals of Justice, Freedom and Honor would have been thrown down, and the God of Brute Force would have been set up in their place.

The cost to Germany and her allies of this monstrous raid upon the world was 3,350,000 dead and 12,070,000 casualties. The assault was met and mastered by the forces of Civilization at a cost of 4,560,000 dead and 19,525,000 casualties. The casualties on all sides reached a total, therefore, of 31,595,000.

Increasingly, as the years roll by, the historians of the future will write it down that this stupendous conflict was fought out to make the world a safe place, not merely for Democracy, but for Civilization itself.

Naval

In any review of naval events during the past year, the outstanding fact is the crowning demonstration of the decisive value of the command of the sea. Mahan explained all that to us years ago. What a pity it is that he did not survive to witness the latest demonstration of the truth of the principles he laid down in his great work "Seapower in History," and take his stand with Admirals Beatty, Sims, and Rodman on the bridge of the "New York", to survey the surrender of the German fleet. Wars can be won by blockade as well as by battle. It was blockade that brought Germany to her knees, and, as a substitute for battles, it is an altogether merciful and humane provision for bringing an enemy to terms. Also, it is an effective means, in time of war, of making sure that the freedom of the seas shall be unobstructed in times of peace.

Although the war is over, not much information is yet available as to the warships and new material which have been developed abroad. Capital ships continue to increase in size, speed, and gun-power. The British have built some battle-cruisers of about thirty-two thousand tons displacement, 33 knots speed, carrying the 15-inch gun in their main batteries, and with moderate armor protection. Also, they have brought out an entirely new type of ship in the "Furious"; a sort of magnified destroyer, as long as the largest Atlantic liners, narrow, of shoal draft and heavily engined. The reputed speed is 40 knots and the reputed armament, as originally placed, was two 15-inch guns. Another novel type is the monitors, of which, we understand, some thirty have been built. They carry a pair of heavy 12- to 15-inch guns, in a single turret. The speed is very low indeed, and they were built mainly to attack the German bases on the Belgian coast. They are practically useless today. The British appear to be satisfied with the 15-inch gun for the main armament of their battleships; the United States will use the 50-calibre 16-inch gun in all future dreadnoughts,whether they be battleships or battle-cruisers. The first four battleships of the 1916 program and the six battle-cruisers will mount this fine piece, which fires a 2,200-pound shell with a velocity of 2,800 feet per second.

The war has served as a fresh demonstration of the efficiency of the United States Navy. It found the navy, as usual, "on its toes." The best of our destroyers were at once dispatched to the submarine zone; 150 new destroyers were ordered; guns were found for arming our merchant ships, and skilled gun crews were sent to man them; 600,000 tons of enemy merchant ships, whose engines had been wrecked by the enemy, were repaired, manned, and quickly put into service as transports. A large fleet of patrol boats was organized; a large air force was enlisted and trained; a big fleet of new and powerful seaplanes was designed and put under construction; seaplane bases were established on the British and French coasts, and the personnel of the navy for manning our warships, transports and merchant ships was raised to 700,000 men. The close of the war finds our navy the second most powerful in the world, and equal in strength to that of the next three of the great naval powers combined.

Military

Unquestionably, the most novel and most effective of the new weapons of warfare developed during the great conflict, was the tank. Its first operations in 1916, in the great British attack on the Somme, were necessarily tentative in character. As the war progressed tank tactics developed in efficiency, and in the 1917 attack at Cambrai, it came into its own by making a 10-mile breach through the German system of entrenchments—this being the first time that an absolute break-through was accomplished. The campaign of 1918 served to introduce the whippet or small "baby" tanks, and in the great counter-offensive operations of this year, both of the French and British and Americans, the tank established itself as the most effective weapon of the offense; in fact, German military commanders openly attributed the success of the Allied offensives to the employment of the tank in large numbers.

The war has demonstrated the enormous military value of the machine-gun, especially as a weapon of defense. But for two American inventions, the machine-gun and the submarine, the German armies would have collapsed long before they did; and it is a fact, that by far the major part of the casualties of the war on land have been due to the heavy and light machine-guns. As regards artillery, the most remarkable development has been the use of guns of the very heaviest caliber in mobile field operations. Before the war, the six-inch howitzer was considered to be the heaviest piece that could be used in the field. Austria and Germany surprised the world with their 12-inch and 16-inch semi-mobile howitzers, and at the end of the war the heaviest and most powerful guns in existence, including the 21-inch gun of the French, were in the field and following up the retreat of the German armies. Notable work in this direction was done by our army and navy, the navy having placed in the field several batteries of 14-inch naval guns mounted on specially-designed railway carriages, and also a certain number of our 16-inch guns. These were used to good effect in shelling important military roads and railway lines in the back areas of the enemy.

Field and heavy artillery cannot be built over night; but the Ordnance Department of the army had begun the construction of a vast amount of ordance, in which was incorporated the ripe experience of our Allies during four years of war, and which included such improvements as had suggested themselves to our own expert artillerists. Had the war been extended into 1919, the Germans would have been subjected to an overwhelming weight of artillery fire from guns of our own design and manufacture.

A weapon which excited widespread interest at the time was the 75-mile gun, with which the Germans shelled Paris. There is nothing novel in the principles employed in the design of this gun. Whatever may prove to be the details of its construction, it will be found to embody an unusually large powder chamber and an exceedingly long bore; the one to provide sufficient powder for a range of such great length, and the other to provide sufficient space or volume in which to develop the expansive energy of the gas. If any nation wished to do so, it would be perfectly feasible to build a gun with a range of 100 miles or over. So far as we know, the Allies have not, as yet, come into possession of any of these guns, and the particulars are not yet available. It is certain, however, that the Germans either built an entirely new piece of 75 to 100 calibers length, or sub-calibered a standard 15- or 16-inch gun by inserting a liner.

Engineering

During a war which was essentially a war of machinery, it was inevitable that projects of peace-time engineering would suffer. The accomplishments of the engineer have been more in the line of thoughtful investigation and planning than of actual construction. The New York State Barge Canal is supposed to have been finished, but this great work has been so completely the football of conscienceless politicians that it is difficult for the taxpayer to find out either just where his money has gone or what he has got for it. God send the day when public utilities will be taken entirely out of the hands of the politician and committed to the unhindered control of reputable and qualified non-political engineers—than whom no wiser, more honorable and more able class of men is to be found in the country. Hydraulic and reclamation work is very much in the air just now; the government talks of vast schemes of reclamation, and of the placing of our returned soldiers on the virgin and fruitful soil. Canada, with characteristic energy, has started upon a great enterprise for the development of 300,000 hydro-electric horse-power from the Niagara River, and she proposes to secure an effective head of 305 feet (instead of about one-half of that as in the case of power plants located at the Falls), by building her power plant at Queenston, below the rapids, where the river level is only two feet higher than the level of Lake Ontario.

According to Dr. Waddell, the well-known consulting engineer, there is under serious consideration the construction of a combined ship, sanitation, and power canal from Lake Erie to Lake Ontario. The total length would be 40 miles and the depth 30 feet. The total fall is 327 feet. The object would be to transfer the largest lake vessels and barges from Erie to Ontario, to divert the sewage of Lackawanna, Buffalo, Tonawanda and other cities from Erie and the Niagara River, purify it and discharge the waters into Lake Ontario; and finally, to develop about 800,000 hydroelectric horse-power. The raising and lowering of ships would be done by huge lift-locks capable of handling 650-foot ships through a vertical height of 200 feet.

The Quebec bridge was tested out in August of last year by running out two heavily laden freight trains, one on each track upon the central 1,800-foot span. The total load was 7,000 tons. The bridge stood the test successfully. In the field of transportation, the most notable piece of railroad construction was the completion last year of the "desert" railroad, which forms the closing link in Australia's first trans-continental line. It took five years, working under a scorching heat, in a country devoid of water and vegetation, to close this 1,000-mile gap. It is now possible to make a continuous railroad journey from Perth, Western Australia, to Brisbane, Queensland, a distance of 3,895 miles.

Electricity

Although electricity is a peaceful force rather than a military one, it has thrived and forged ahead during the past year of war.

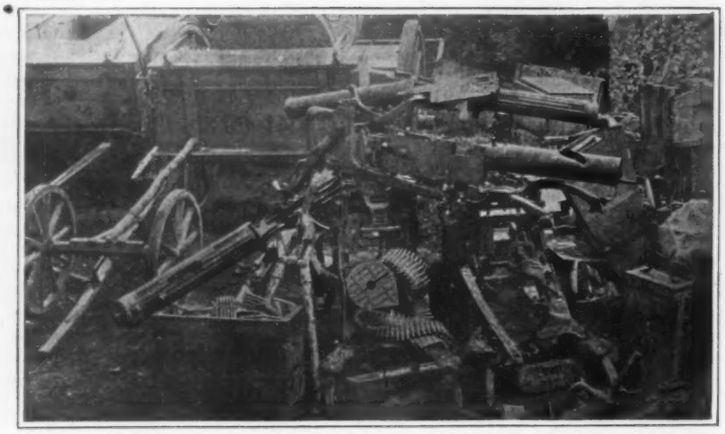
The scarcity of coal in certain countries has given a tremendous impetus to hydro-electric developments; so that in Norway, for instance, hydro-electric power is now being employed to an unprecedented extent. And the generation of this cheap form of electric power has brought about the extensive application of electric current in industrial pursuits, particularly in the metallurgical field. Much has been done in establishing large aluminum producing plants and electric steel works. As a result of this inexpensive and abundant electric energy, the electro-chemical industries have benefitted in no small way.

To the electric welding art, the past twelve months have contributed much. All kinds of applications have been found for this method of joining metals together. Interesting researches have been carried out with regard to the electric welding of ships, instead of the usual riveting process. As yet the electric welding of ships is still in the experimental stage, although it is acknowledged to have certain important advantages over the existing method, particularly in the matter of labor.

In the field of radio communication, the progress during the past year has been considerable. The radio telephone has been developed to a point of relative perfection, due to the use of the vacuum bulb generators in place of the former troublesome and uncertain arc generators. With the lifting of the veil of censorship, we learned of the wireless telephone for communicating between airplanes and ground stations, making possible the greatest precision in air fleet maneuvers. Indeed, at the recent aviation meet at Belmont Park, N. Y., the spectators were thrilled by the unison of movement of an entire fleet of airplanes; and it was several weeks

(Continued on page 9)

A pile of salvage at Ration Dump H of the 77th Division, and some men from Salvage Unit 18, Q. M. C., who handle salvage in this locality



German machine-gun ammunition carrier and a collection of French machine-gun parts from a dump of Salvage Squad No. 1, Q. M. C.

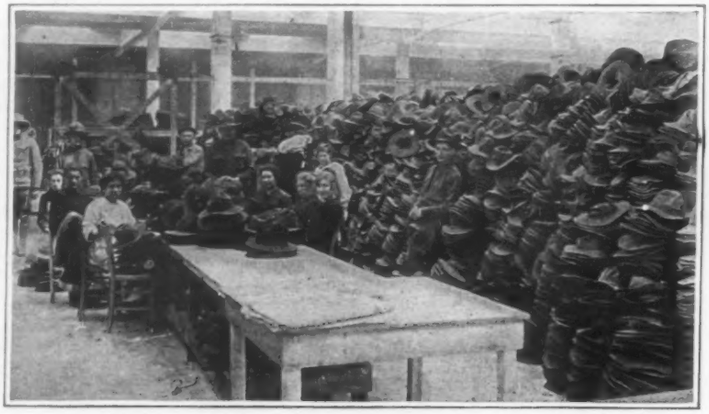
Where Nothing Goes to Waste

Glimpses of the United States Army's Salvage

A SALVAGE plant for the recovery and proper use of waste material has been organized on a large scale by the Army near one of the large towns of France. No army in the world has anything like it, and not a day passes that representatives from some of the Allied Governments do not inspect it and take notes on its operation. It has saved, not thousands, but millions of dollars for our Government. We will mention the various kinds of work which are carried on in some of the departments of this vast salvage plant.

For instance, the shoe department is one of the most important, and shoes and boots are brought in by thousands of pairs. They are first washed and disinfected, sorted, and then given out to be repaired, inspected and packed for shipment again. The production in this branch is about 3,500 pairs per day. The total value of the output for one month was $449,599. About 80 per cent of all shoes received are repaired. New machinery is being constantly added to this department, and when it is completely organized, it is expected that 7,000 pairs of shoes will be turned out daily. At the time of writing this branch employed two officers, seven non-commissioned officers, 114 enlisted men, 280 male and 249 female civilians.

The depot has seven operating departments, laundry, clothing, shoes, rubber goods, harness and leather equipment, canvas and webbing, and metals. The laundry alone employs 206 workers, over half of whom are civilians. All sorts of new devices in machinery are used, save hand labor for washing, rinsing and drying; and more than 75,000 pieces are turned out per day. The clothing is probably the most important department. Its production is limited almost entirely to breeches and blouses, underwear, bed sacks and blankets. The daily output is 10,000 woollen breeches or blouses, 25,000 of underwear or bed sacks and 500 blankets. After coming from the laundry the garments are examined and marked for repair, or if not reparable they are cut up for patches. The patches necessary for the reparable garments are cut entirely from the irreparable ones (15 per cent of the total), and then sent out to the various branches for the actual sewing, after which they are classified either for reissue to the troops in active service or for depot troops or labor battalions. About 1,600 women are employed in this branch, and 75 men. The value of the production for a month was $2,040,831, while the operating costs came to the relatively insignificant total of $93,432.



Working old hats over into new hats and bedroom slippers

Not a scrap of anything is wasted. Hospital slippers are made from old campaign hats that have been discarded. The question has often been asked as to what became of these hats. In fact they are of an excellent quality of felt, and no matter how old and worn they are, the felt is utilized in the soles of the slippers. The uppers are made from old woollen garments thrown aside as quite irreparable. Overseas caps are another specialty made from old uniforms unfit for repair, and brassards are manufactured by the thousands for the various army services. Old garments are dyed green and marked "P. W." to be used by the German prisoners of war. The old trench shoes that have already been mended and are now beyond repair, are cut up into shoestrings. No matter how worn the shoes are, there is always a piece of leather left in the uppers large enough to make several pairs of strings.

The rubber goods branch also shows remarkable figures for saving. It handles primarily rubber boots and arctics, "slickers," ponchos and shelter halves; it produces about 3,000 garments and 850 pairs of boots per day. The great feature of the department is the new vulcanizing machine recently put into

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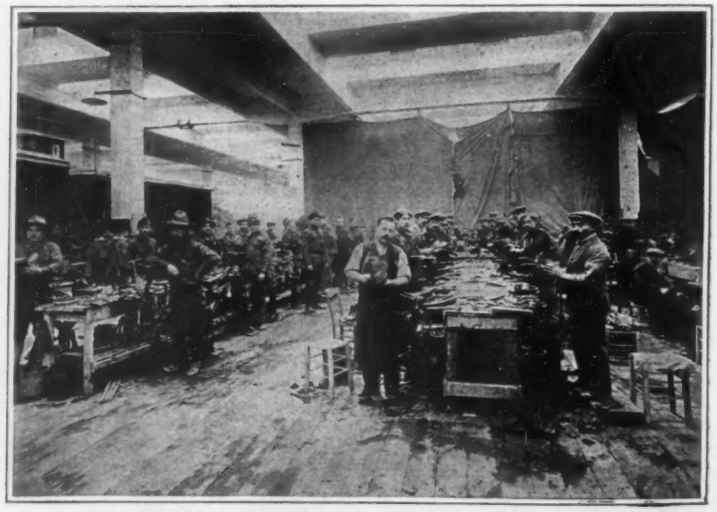
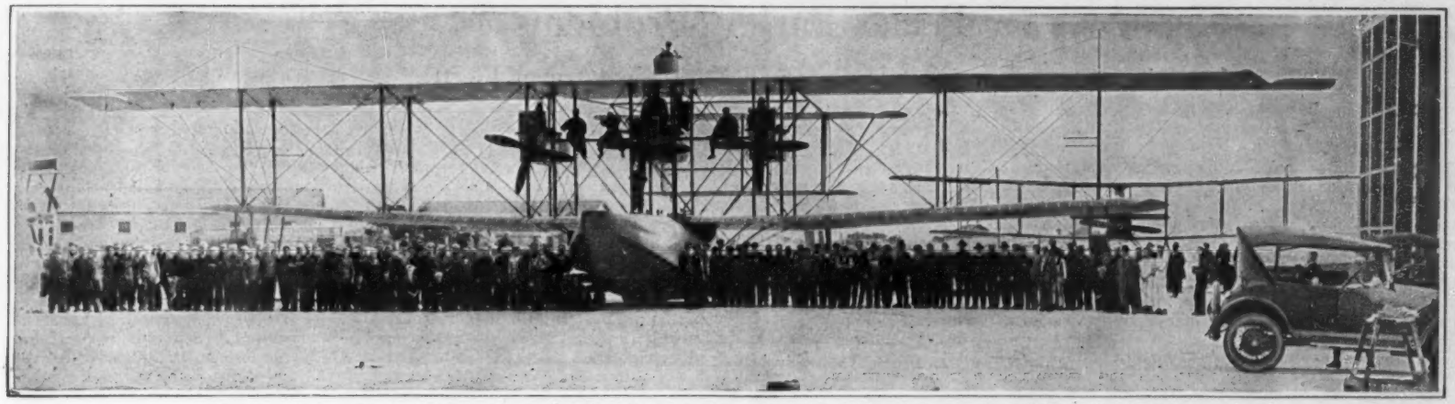
Washers and extractors at work cleaning discarded United States Army clothing



French cobblers at work in an American Army Salvage Depot



Our Navy's largest aircraft—the N. C. 1 employed for coast guard work, which recently made a flight with fifty passengers

Our Giant Aircraft

Where We Stand in the Matter of Transatlantic Flight

THINGS move swiftly in the flying world. It seems but yesterday that we were awed at the size and power of the "America"—the flying boat built by Glenn H. Curtiss for Rodman Wanamaker, who was backing Lieut. John Cyril Porte, R.N., in his attempt to win the $50,000 prize offered by the London *Daily Mail* for the first transatlantic flight. Today there are hundreds of airplanes as large or larger than the "America"; in fact, flying boats of that general type have been in quantity production for some time past at our Naval Aircraft Factory. So the marvel of yesterday has become the commonplace of the present; which is another way of saying that this is the day of giant aircraft.

Prior to the great war, the efforts of all aeronautic constructors, with the exception of a Russian engineer, Sikorsky, were confined to relatively small planes. From a military point of view, there was no need for huge airplanes; and, indeed, the smaller the type the more it appeared to be suited to war's requirements. During the war, however, the belligerents soon came to appreciate the military value of aerial bombing, and soon set to work on fleets of bombing planes. Germany, in order to bomb English towns, constructed her Gothas and Friedrichshafens after the failure of her Zeppelins; Italy constructed her Caproni biplanes and triplanes for bombing Austrian military centers on the other side of the Alps and far in enemy territory; Great Britain constructed her Handley-Pages for the purpose of repaying the Germans in their own coin. France, on the other hand, did not take to long-distance bombardment, probably because of her geographical location which made her an easy target for German bombing fleets. To bomb the Germans, according to the French viewpoint, only served to provoke their bombing fleets to greater efforts. Finally, the United States set to work building huge planes of the Handley-Page and Caproni types for long-distance bombing.

Another feature of the war which gave impetus to the big plane movement was the submarine warfare. When the value of aircraft in anti-U-boat operations became manifest, the Allied navies set to work developing seaplanes and flying boats capable of making long flights and carrying suitable armament, including depth bombs. Then it was that Great Britain went back to the "America" type of flying boat, and started with that huge type as a foundation. Today the British and American navies have large fleets of flying boats of the same general type as the old "America," equipped with two Rolls-Royce or Liberty engines aggregating between 600 and 800 horse-power, and capable of maintaining themselves in the air and on the water for long periods.

More recently our Navy has come into the possession of a still larger flying boat, designed and constructed by Glenn H. Curtiss, which may well be included in the category of the largest heavier-than-air craft in existence. Several weeks past, this flying boat, officially known as the N. C. 1, made a flight off Rockaway, N. Y., carrying 50 passengers with ease. Its lifting capacity is said to be five tons.

The N. C. 1 is depicted in the accompanying illustrations, which serve to give a good idea of its magnitude and general design. It is equipped with three 12-cylinder Liberty engines, driving three four-bladed tractor screws. The wing spread is 126 feet. From prow to tail she is 70 feet long, and from the gunner's cockpit on the top wing to the keel is a distance of 25 feet. The distance between the upper and the lower planes is 12 feet, which also happens to be the depth or chord of the planes.

The seating arrangement is quite odd. In the center of the top wing is the observer-gunner's post, with nothing to interfere with his view and his shooting. The pilot's quarters, provided with two seats and two sets of controls, are located in a nacelle between the planes. Below the lower plane, seats for four are fixed, and below that the boat part of the plane has a capacity for a number of observers or passengers. As equipped for coast-guard duty, the plane carries 300 gallons of fuel, which is sufficient for many hours' flight. By doing away with the armament and other military equipment of the N. C. 1, its cruising range might be increased to 40 or 50 hours without difficulty.

Given ideal weather and good seamanship, the N. C. 1 or a similar craft ought to be able to make the transatlantic flight. In fact, it is generally held by those who know that such a flying boat can readily be prepared for the flight with every prospect of success. Because of its sturdy construction and its ability to alight on fairly rough water, the flying boat possesses many advantages over the land type of aircraft. In this connection Mr. Glenn H. Curtiss has recently remarked that marine flying will be developed quicker than land flying, because no new landing fields are required. Terminal facilities are already provided, for quiet harbors, rivers and small lakes are

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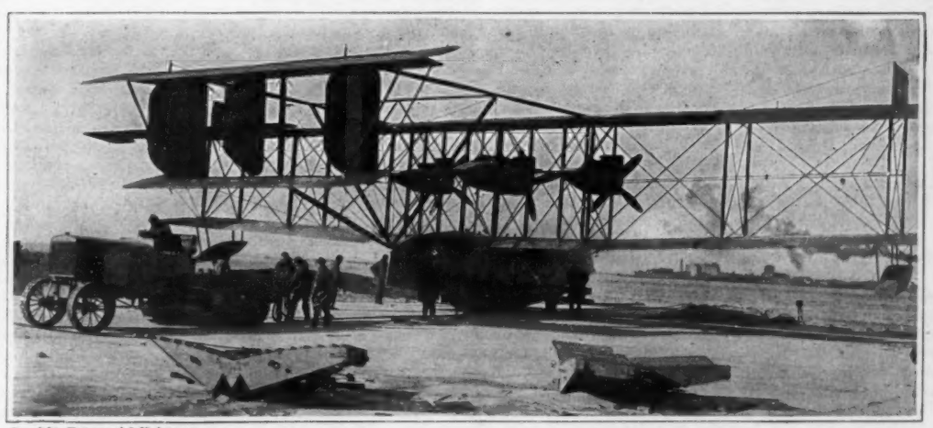

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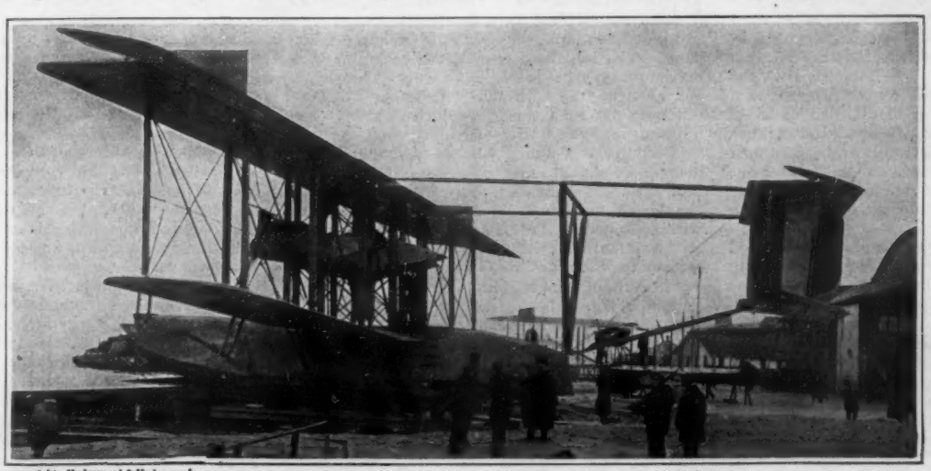
The N. C. 1 flying boat as viewed from the rear, the three engines and their four-bladed tractor screws



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Side view of the giant seaplane, showing the biplane tail with balanced elevators, at the end of the outriggers

Peace Parley Problems

What Should Be Done With the German Fleet

By Hudson Maxim

IF a league of nations is to be practical or workable, it will be necessary for Great Britain and the United States to agree upon the size of their respective naval building programs, and to agree upon the size of their respective and prospective fleets. If we are unable to agree with Great Britain upon the division of the German fleet, we certainly can not hope to agree upon anything in the world, especially upon a more difficult matter still—that of the size of our respective future fleets.

Such a league to enforce peace would not be a peace league, but a war-breeding league, if the two largest nations that are parties to it are to enter upon a race for naval supremacy. Such a race would in itself be war. The rivalry between Germany and Great Britain in fleet building was a war to the knife, and the actual war with the knife came in 1914 as the result of it. It seems the height of impolicy for us now to throw down the gauntlet to Great Britain and take up the race for naval supremacy where Germany left off.

We need no defense against Great Britain on the Atlantic, any more than we have needed or now need any defense on the Great Lakes. We do not need to fortify the seas to protect ourselves against Great Britain any more than we need to fortify the Great Lakes. With all her fleet and all her armies, Great Britain is utterly disarmed against us, because she would have nothing to win, nothing to gain, from any dissension or war with us, but everything to lose.

Great Britain does not fear the loss of Canada to us, otherwise she would want to fortify the Great Lakes. If Great Britain should go to war with us, she would inevitably lose the Dominion of Canada to us and that would more than offset any possible advantage that she could gain from the prowess of a superior fleet. No power on earth could stand before the American army on this continent, if we profit by the lessons of this war and prepare according to our needs.

In the event that we can not agree with Great Britain with respect to the division of the German fighting ships, why not sell them to some of the small nations who are building fighting ships and who would be glad to buy them? How about Brazil, Argentina, Chile, Peru?

The money raised from these ships would go far toward reimbursing Great Britain for her losses and expenses in the war, and we should welcome an opportunity to help Britain in this way—Britain, that for the first three years of the war saved our land from the threat of invasion and spoliation.

Before the Great War, we used to talk in millions when we discussed naval and military appropriations and congressional expenditures; but since the war we have got so used to talking in billions that we have evidently lost much of our sense of proportion. A billion dollars represents a sum of money which to raise from the hundred million American people would require a tax equal to ten dollars for every man, woman and child in the country. The German fleet is certainly worth more than half a billion dollars. Now, think of the sheer folly of wantonly destroying property of such colossal value, while we go right on building new fighting ships.

If our naval program is carried out, and we enter upon a race for naval supremacy with Great Britain, as contemplated, and keep up with Great Britain—because she will continue to build if we do—it means that the American people, within the next ten or fifteen years, will be obliged to bear a burden of taxation equal to fifty dollars a head for every man, woman and child in the country, amounting on the average to $250 per family, and there will be a colossal annual tax for the expense of upkeep, manning and running such a navy.

Is there no way to protect the interests of the American people against such colossal folly?

No one can accuse me of being a small-navy man. I am as strong for national defense as any man living. But the fact that the people of Great Britain and ourselves are mainly of the Anglo-Saxon breed, with common ideas and ideals, aims and ambitions, is the strongest possible element of security. We should league ourselves with Britain as our own States are leagued to one another, and there should be no more cause to fear Britain than for one of our States to fear another State.

Great Britain's fixed habit of good behavior is the greatest guarantee of world peace. It is greater than any league of nations.

It must be borne in mind that Great Britain has more navy than she needs at the present time, and while we may need some naval increase, we do not by any manner of means need a navy as large as that of Great Britain.

We must bear in mind the fact that Great Britain is differently situated from the United States of America. If the continental area of the United States were to be cut apart into as many islands as there are states, and these islands spread over the seas of the earth, then we should be in a position largely like that of Great Britain, and we should then need a larger fleet than we now need, just as Britain needs a larger fleet than we need. Great Britain's life is her fleet. Our life is within our continental confines, and our fleet is an auxiliary.

We could, with a little time for adequate preparation, defend ourselves indefinitely against the world in arms, even though our fleet should be destroyed and all our outlying possessions captured, and we should also be able to feed ourselves for an indefinite period, even though all connection with the outside world should be cut off.

But Great Britain is situated otherwise. The British Isles and all her colonies would be absolutely at the mercy of any enemy that should be able to overcome her fleet.

We do not need so much of a fleet as does the widely scattered British Empire. In case of war with Britain, which is now an absurd supposition, she could under no circumstances concentrate her entire fleet upon any point of our shores. We should still, therefore, have a preponderance of fleet power where needed, a power sufficient to protect the Panama Canal even though our fleet should be incomparably smaller than that of Britain.

We need a fleet in the Pacific Ocean of a size sufficient for our protection against any Asiatic Power or combination of Powers. With such a fleet we should be able to protect our continental areas from aggression from any British fleet that might enter the Pacific.

Although it is my opinion that war with Japan is now most unlikely, still I believe that we should have a fleet of sufficient size to make any war with Japan equally unlikely in the future. Japan is so situated today that she could only lose by a war with us. The Japanese are far too wise and practical to go to war with us.

In conclusion, let me call attention to the pertinent fact that no American at the present time has the least fear of Great Britain. It is inconceivable that Great Britain should take advantage of her tremendous naval preponderance and her preponderance in fighting men and munitions of war to commit any acts of aggression against us, much less to go to war with us.

Our comradeship with Great Britain in the war has bonded the two nations in strongest ties of obligation, fellowship and admiration, and this bond should now be utilized and joined with the bond of a league to compel good behavior of all the nations of the world.

It is time that the two great Anglo-Saxon nations should get together and stand for world welfare.

Road vs. Load

DURING the stress of the past 18 months our highways have been used and abused as never before; and they have not always stood up well under this treatment. The wear and tear of the constant passage, at maximum speeds, of heavy trucks heavily loaded, and even of trains of such trucks, has taken a severe toll from our road surfaces, which in many cases were not built for such a strenuous life.

It has been obvious for some time that in mere self-defense we should have to limit the loads put upon our highways. It is all very well to say that the highways should be equal to the demands; but this is true only within proper limits. Every engineering structure has its maximum capacity; the Brooklyn Bridge will carry a given load and no more, the foundations of the Woolworth Building will support a given weight, its walls will withstand a given wind-pressure, and no more. In cases like the last-named, we can calculate in advance the greatest load ever possible, and provide a margin of safety above it; but when the load is one imposed by human action, as in the instance of the bridge and the highway, we can never tell what demands will be made upon our structure by our successors, and so can never make certain that what we build shall continue to give service until it wears out naturally.

To the extent that roads built for passenger and farm service are now being cut to pieces by through and local interurban freight traffic, the demand that such traffic be regulated is a reasonable one. To the extent that roads built to support the normal trucking of five years ago are being torn apart by five- and ten-ton trucks and long lines of trailers, that demand is reasonable. To the extent that no matter how strongly we build a road, a load can be imposed that will break it down, that demand is reasonable. But—in meeting that demand we must be reasonable toward traffic as well as toward the road-builder; having permitted the pendulum to swing too far in the interests of the former, we will never correct the situation by allowing it to go too far in the other direction. We want to stop it in the middle of its path, giving to all concerned their just due.

A Committee of the Highway Transport Commission of the Council of National Defense has discussed the question of a uniform traffic law for federal adoption or for recommendation to the various states. At present such traffic laws as exist are so different in different neighboring states and different localities as to cause confusion and annoyance. If the Committee does not succeed in its efforts to bring order out of chaos, the continual enactment of further regulations by various local or state bodies may be expected.

At the present time there seems to be a tendency, on the part of those interested, to favor a maximum load of perhaps 12 or 14 tons per unit—the figure is immaterial. It seems to us that this is not the intelligent treatment of the case. Somebody has pointed out that the largest tank or crawling tractor can travel over ground that would be impassable for an ordinarily shod lady—because while the machine weighs many times what the lady does, it has so much bearing surface that it brings less weight upon each square inch of its supporting ground than does miladi in her French heels and pointed toes. It seems no more than just to recognize this principle in the matter of highway overloads.

A weight that would smash cleanly through the road if supported on old-fashioned buggy wheels, and that would cause serious wear and tear if transmitted to the road-surface through the ordinary truck tires, would be supported in perfect safety if it rolled along the highway on the traction belt of a crawler or even on the rollers of a steam-roller. So the sensible test for limit loads would seem to be so much per tire inch.

Of course there is a limit beyond which unit loads should not go—simply because there is a limit beyond which distribution cannot go. A load of 1,000 tons would be supported, without damage, by any roadway, if it were of sufficiently wide distribution. But no 1,000-ton load could be sufficiently widely distributed while remaining mobile, on wheels or substitutes therefor. So it would be proper enough to specify that no axle shall bear more than a certain load, and that no two axles shall be less than a certain number of inches apart. But this is as far as the restriction of unit loads should go.

Again, experience has shown that a tire which is not subject to tractive strain need not be more than half as wide, for a given weight, as one that is subjected to traction. Therefore, should a rigid recommendation be made for a certain limit weight per tire-inch, it would not be fair to the trailer owner who would then have to use bigger tires on his trailer than necessary. In fact, the tires themselves afford excellent argument in favor of this course. There is no better way to tell the relative damage done to the road by various classes of traffic than by assuming that the highway suffers in proportion as the tires suffer. In other words, if a dual 6-inch tire on a driving wheel and a single 6-inch tire on a non-tractive wheel wear out at the same time, it is safe to assume that the one has done about the same damage to the highway as the other. On this basis, the maximum weight per tire inch should be set at one figure for wheels to which power is applied, and at a higher figure for non-tractive wheels.

Figures that have been suggested by one well-informed person are 800 and 1,200 pounds per tire inch for these two classes, respectively. From the same source comes the specific recommendation that no axle be permitted to carry more than nine tons, and that no axles be set closer than 100 inches. The important thing about all this, however, is not so much the figures as it is the ideas involved. To all bodies that are contemplating legislation designed to relieve our roads from the destruction that has been wrought upon them by excessive motor traffic, we earnestly commend the lines of thought set forth.

Review of the year 1918

(*Continued from page 5*)

before we were told of the wireless telephone which permitted the orders to be issued from a ground station. Radio communication over long distances has been greatly improved by numerous inventions which, on the whole, remain military secrets. Static, the arch-enemy of long-distance wireless, has been definitely conquered, according to a recent announcement of the Marconi organization; and the tall masts and elevated antennæ usually associated with radio have been replaced by low masts and antennæ, marking a new era in this branch of communication.

Not to be outdone by radio, the land lines have come in for a number of improvements, among them a new multiplex system which permits of increasing many fold the present telephone and telegraph capacity of wires. Automatic telephony has come to the front in a big way; and because of the severe shortage of help, the largest telephone companies have had to consider the automatic telephone for use in the leading cities.

In the field of electric illumination, the progress has been considerable. Flood-lighting has found new applications in protecting munition plants and military works, aside from its esthetic applications which were more or less suspended during the war. The arc used in motion-picture projectors has been displaced by a nitrogen-filled incandescent lamp in projectors of limited power.

Militarily, there was little achieved in the electrical field; for, as already stated, this force is a peaceful force. However, in the course of the past year the Germans introduced their crewless raiders in attacks on the British monitors operating off Flanders. Thus they put into practice an idea which was by no means new; but fortunately, thanks to the vigilance of the British crews, nothing came of the German scheme. On land electricity found such military uses as charged wire entanglements, improved X-ray outfits and portable lighting plants.

Aeronautics

The past year has been a great one for aeronautics. Vast strides were achieved in practically every branch of the flying art; and the twelve months of unprecedented effort were fittingly crowned by the fifteenth anniversary of the first flight by the Wright brothers, which took place in the sand dunes of Kitty Hawk, N. C., during December, 1903.

Spurred on by the demands of the military leaders, the leading aeronautic constructors attained their divers goals just prior to the signing of the armistice. The swift pursuit planes for fighting purposes had been developed to a point where a speed of 125 to 150 miles an hour was a *fait accompli* rather than a product of imagination. Giant planes of the long-distance bombing type were beginning to make their appearance in vast numbers. Germany had constructed a number of Gotha-Lizenz planes capable of carrying five tons of bombs for the purpose of bombing ports of debarkation in France. Great Britain had constructed giant Handley-Page machines fully as large as any German plane, for repaying Germany in its own coin. The Allies had constructed entire fleets of small and medium-sized dirgibles for naval work, as well as numerous large and fast flying boats carrying thousands of pounds of explosive for the lurking U-boats. The armament of fighting planes had been developed to a high degree, so that some planes carried as many as six guns, and few had less than two.

All in all, and from a military and naval point of view, the aeronautical constructors have quite fulfilled all obligations.

America's progress has been stupendous during the past 12 months. After many disappointments and setbacks, our aerial program at last got under way. Thousands upon thousands of Liberty motors and De Haviland two-seaters made their way to our battle lines in France, where thousands of pilots and other aerial personnel were ready to man them. Also, our aircraft constructors succeeded in turning out excellent copies of the British Handley-Page and the Italian Capronis, equipped with the Liberty motors. Our Navy completed the Naval Aircraft Factory in record time, and numerous giant flying boats were dispatched to European waters for use against the U-boats.

In all the leading countries aerial postal services have been introduced during the past year. The winged postman is fast become quite commonplace, with one route after another being added to this latest network for handling mail. In the last month of the past year, reports have come from all the belligerent countries telling of the vast efforts being expended in converting the planes of war into planes of peace. All of which promises much for the commercial future of aeronautics.

Chemistry

Characteristic of the year's chemical advances has been the enormous development of chemical machinery. Reactions which in the laboratory proceed in test tubes have been put upon a commercial basis of quantity of production that would astound the chemist of a generation ago, who would perhaps fail to recognize the operations as those of chemistry at all, so altered is the method of attack. The year's developments have been so strongly along these lines that we must catalog them in terms rather of the factory than of the laboratory.

The coal-tar chemist assures us that he has solved the last of his big problems of dye manufacture. The knowledge of principles and methods gained by the Germans has been so systematically withheld, and even falsified, that that knowledge cannot be said to have constituted part of the general body of science. The labors of the past three years, crowned by the results of 1918, have made it such a part.

In glass-making the year's developments are even more striking; glass is produced today superior to anything ever known, both for optical and for other use. Our ability to handle paper, Nature's composite, has been advanced far, so that this substance is finding a surprising variety of new uses. By an alliance between the chemist and the mechanical engineer the process of dehydration, which means so much in the world's food supply, has been put on a solid foundation. At the same time the chemist has made the world less dependent on a single cereal by showing us how to make good bread with a minimum of wheat.

As a result of concentration upon the problems of gas warfare, a large and valuable body of knowledge has been built up with reference to the toxic effects of a wide variety of poisons, and the proper antidotal and preventive measures. At the same time a number of commercial gases have been developed and some old ones are being manufactured at a fraction of their former costs.

Among the purely research activities completed during the year, we must mention two undertakings of the Bureau of Mines. The first brings cheaper radium closer to realization; the second identifies the characteristic property of selenium in a number of other metals and oxides, all of which show an electro-resistance varying more or less markedly under the influence of light.

Science

Under this unclassified heading, perhaps the most important thing to chronicle is the acceptance of the motion picture as a new scientific instrument. Alone or coupled with the microscope, at normal or abnormal speeds, as a means of actual research or as an agent for proving results and spreading knowledge thereof, the moving film has this year proved its place; it now ranks with the camera and the microscope as one of the recognized optical tools of science.

Perhaps in no field of science has the war stimulated such sudden and such notable advances as in that of the psychologist. He has had unprecedented opportunity to observe the behavior of men under conditions of stress; and he has been called on to make tests, and perforce to devise machines and methods of test, on a scale never before contemplated. He has proved his technique to himself and to others, so that he now stands on a level of achievement and recognition that he could not have attained in years of normal activity.

Other interesting developments of the year include quantitative spectrum analysis and magnetic analysis. The former makes available, as an accurate means of determining percentages, what has hitherto existed only as a means of preliminary qualitative test; the second opens up a broad field to the strength-of-materials engineer, who has seldom been able to devise a test that did not destroy the material subjected to it.

Astronomy

At first blush, one would be inclined to class the work of the astronomer among the non-essential occupations. To be sure, his studies take him far beyond the insignificant speck of the universe which is our habitation. Nevertheless, tiny as is our earth, to us who dwell thereon, the events of the past four years have been of paramount importance. But in reviewing the recent work of astronomers we find that they have taken a very active part in the war. The astronomers of this country and of our Allies have been very busy teaching in the navigation schools, testing optical instruments, improving the work of the range finder, and even operating at the very Front. Despite the handicaps of war a considerable amount of research work has been done in the past year. Two comets were discovered, the first at Cape Town, by Reid, on June 12th, and the second by Schorr, at the Hamburg Observatory, on November 23d. As the result of patient research by Fowler on spectra of the sun, he arrived at the startling conclusion that there is water vapor and ammonia vapor in the sun's atmosphere. Heretofore, it had been supposed that the intense heat of this luminary would prevent the formation of any chemical compounds; but this supposition needs revision in the light of Fowler's researches. Long photographic exposures, lasting 70 hours, have shown that the inner portion of the nebula of Andromeda rotates at a speed of 50 miles per second, from which it is estimated that the outer portion probably attains a speed of 200 miles per second. A small star near Alpha Centauri lays claim to being our nearest companion. Its distance has been estimated as between 4.1 and 4.3 light years from us. It is a cool star, only one-thousandth part as bright as the sun.

During the year there were three eclipses of the sun and one of the moon. The most important eclipse was that which took place on June 8th, when the shadow of the moon swept across the United States from Oregon to Florida, in a belt from 70 miles to 50 miles in width. It is the first total eclipse that we have had since May 28th, 1900. By a remarkable coincidence, on the day of the eclipse a new star was discovered in the constellation of Aquila, which was the brightest star to make its appearance in the last three centuries. It reached the magnitude of 1.4, almost that of Sirius. Photographic records of that portion of the sky taken at Harvard University show that on June 3d it was of normal brightness. Owing to cloudy weather, that region was not photographed again until the 6th, when the star appeared as of the sixth magnitude. On the 7th, its brightness had increased 200 times and it was clearly visible to the naked eye—in fact, there are reports of its having been seen, although the news was not transmitted to any of the astronomical observatories. On the nights of the 7th and 8th, its brightness had increased 100,000 times and then it was so conspicuous an object that reports of its discovery were telegraphed to Harvard Observatory from all parts of the country. Another nova was reported on February 4th in Monoceres which reached a magnitude 5.4 on January 1st, although its magnitude was 8.5 when discovered. In March, Wolff reported a faint object which at first was thought to be a comet, but it proved to be an asteroid with a period of four years. This tiny member of the solar family has a diameter of but two and a half miles.

After having been greatly delayed by the war, the Smithsonian Institution has at last established a solar constant station at Calama, Chile, at an altitude of 2,250 meters.

Proposed Swiss National Trade-Mark

A COPY of the regulations under which it is proposed by Swiss chambers of commerce to establish a Swiss national trade-mark under the name of S. P. E. S. (Syndicat pour l'Exportation Suisse) discloses the fact that the mark will be confined to firms two-thirds of whose capital is Swiss and to goods that are made in Switzerland exclusively by the Swiss. Thus any foreigners manufacturing in Switzerland will not be able to use this trade-mark for goods manufactured by them in Switzerland. The object of the trade-mark, it is stated, is not to place foreigners at a disadvantage, but to ensure that any articles bearing S. P. E. S. are to be really of Swiss manufacture. In addition, the mark is directed against German penetration, as numerous firms are known to be ostensibly Swiss, but in reality German. The president of the Geneva Chamber of Commerce states that the control of these will not be easy, but the committee is alive to the probability of improper use of the mark, and they consider that it will be necessary for Swiss manufacturers to bring cases of this character to official notice. No foreign firms are to be prevented from manufacturing in Switzerland; but not being Swiss, they are to be debarred from using the trade-mark. With regard to the possibility of the extensive misuse of the trade-mark by exporting merchants, it may be necessary to add the manufacturer's name to the trade-mark. This may not be acceptable to exporters, and if impracticable and the trade-mark fails as a result to protect Swiss manufacturers, it is considered probable that the chambers of commerce concerned will propose its abolition.

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The Dogs of War

What the Canine Has Contributed Toward the Allied Victory

THE dog may well be proud of his splendid record in the great war. For, while acknowledging the great services rendered by other military animals, such as the horse, mule, and carrier pigeon, the dog has the distinction of having served in the front-line trenches and even out in No Man's Land, where only the bravest dared venture.

It was quite natural for the Belgians to employ dogs in military operations, as they had been doing in the days of peace. So early in the war the Belgian machine guns were mounted on light carts and drawn by trained dogs, with the result that the few machine guns available to the Belgian army accounted for more than their due share of German invaders, because of their extreme mobility.

Other armies soon introduced trained dogs in their organization, using them as watch dogs and despatch carriers at first, and later for carrying food and ammunition to the first line, as well as medical supplies to the wounded lying about the battlefields. Indeed, the dogs have constituted a distinct and recognised branch of each of the leading armies, with recruiting bureaus, training camps, extensive quarters behind the lines, and elaborate hospitals.

During the last days of the great war the French army had some 10,000 dogs in active service. These canines were employed as sentinels out in No Man's Land, where the keen senses of these four-legged combatants gave warning of hostile prowlers long before they could be detected by the poilus. Dogs were also employed to guard prisoners; and, thanks to careful training in distinguishing the poilu from the Boche, canine guards were used to a considerable extent, thus relieving large numbers of French soldiers for more important duties. Still another use for the war dogs was in the carrying of despatches across territory under fire. As a liaison agent the dog was found to be without equal; for these four-legged couriers passed unfalteringly through barrages and areas under machine-gun fire, where it would have been worth a man's life. Even in gas-soaked territory the dog couriers were employed, being equipped with special gas masks for just such circumstances. And then there is the all-important question of maintaining the supplies in front-line positions under enemy fire. Here again the dogs served admirably in bringing up food and ammunition to the beleaguered troops.

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One of the extensive kennel parks for the messenger dogs serving with the British armies in France

It has long been recognized that the question of maintaining supplies is one of the most difficult to solve in the usual trench operations. By the use of an intense artillery barrage, it is possible for an enemy to isolate any given bit of trench system almost as effectively as if his troops encircled it. Appreciating the possibilities of the war dog as a carrier of supplies in small quantities, the French worked on this form of supply service. Special harnesses and carrying pouches were developed for all kinds of supplies, and dogs were trained to carry various articles ranging from hot soup to hand grenades for the trench defenders.

The results of some of these studies are shown in the accompanying group of photographs made at the French military kennels at Camp Satory. The first view depicts a canine soup carrier. This dog, by means of the special harness and the cans shown, can carry two cans of soup or other food across No Man's Land or anywhere else.

The second view shows a four-legged ammunition carrier, in this case provided with pouches holding the supply of grenades shown beside him.

The third view shows a canine shell carrier, with his usual load of 20 shells for the 37-millimeter cannon. It will be recalled that in previous descriptions and discussions of this small cannon, which is a form of so-called accompanying artillery, the difficulty of maintaining a steady and adequate shell supply has been pointed out in these columns. Apparently the French have solved it with the dog shell-carrier.

The poilu, who is a tremendous bread eater, receives his daily bread up in the front-line trenches—German barrage or no barrage—thanks to the services of the dog

All photos French Official

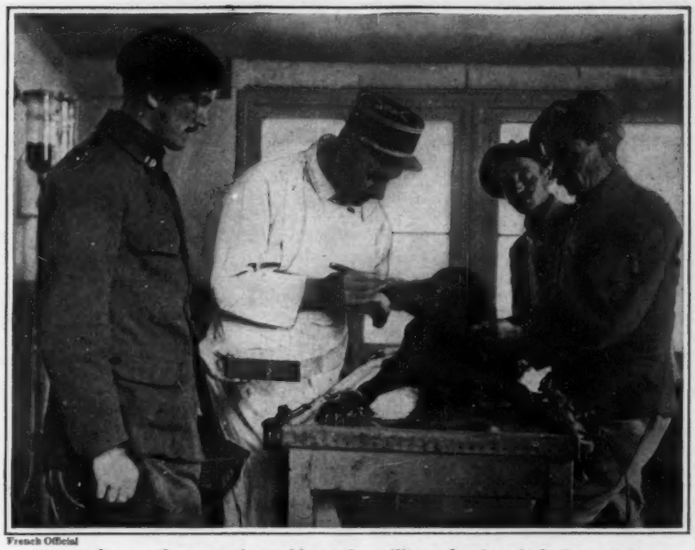
1. Soup carrier. 2. Hand-grenade carrier. 3. Carrier of 37-mm. shells. 4. A row of kennels at Camp Satory, just before mess time. 5. Thirteen loaves of bread are this dog's burden. 6. About 250 rounds of machine-gun ammunition are carried by this canine runner.

Some dogs of war which served to maintain supplies for defenders of beleaguered trenches

shown in the fifth view. This dog carries 13 loaves in one trip. Likewise the machine guns, which simply devour cartridge belts or clips, must be supplied constantly if a position is to be held. And here is where the dog shown in the sixth view comes in for his share of service, carrying 250 rounds of ammunition at a time. In the center or fourth view appears a row of kennels at Camp Satory.

During the year 1917, over 5,000 French war dogs were treated for wounds and ailments, of which 4,196 were returned fit for duty at the front. The most skilled dog specialists of France are engaged in caring for the thousands of war dogs; and the medical and surgical facilities, as shown in the view to the right, leave little to be desired.

The war dog has a distinct application in the reconstruction period of France and other countries. As a companion and guide for the blind soldier, the trained dog continues to serve the nation. For the wounded, there have been developed light two-wheeled carts drawn by one or two trained dogs; and it may be that vehicles of that kind will be the means of enabling many a crippled warrior getting about in the coming days of peace. For police duty the war dog is well fitted with practically no additional training; in fact, the first war dogs came from the police departments of Paris and other leading cities of France.



French Official

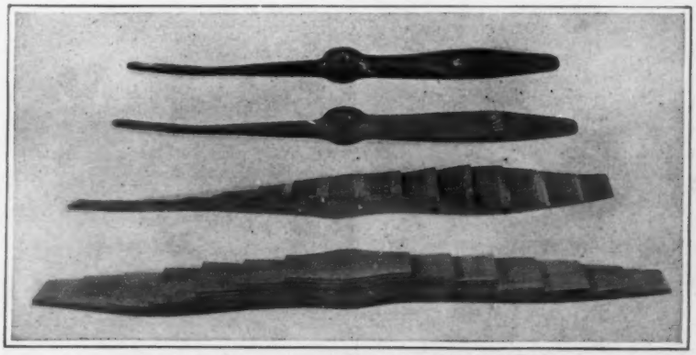
A war dog on the operating table at the military dog hospital, Camp Satory

It so happens that the writer has come into the possession of facts and figures concerning the French war dogs only, but there can be no doubt that the British and the German armies have employed dogs just as extensively and thoroughly. There has been no monopoly in the enlistment of dogs in the great military operations on all fronts; and once again the dog has proved to be man's greatest friend among all animals.

Molded Airplane Propellers

IT is customary to make airplane propellers of laminated wood. Layers of veneer of various woods, carefully selected according to various qualifications of tensile and compressive strength and of toughness, are cemented together and built up into a solid block, out of which a propeller is carved. One disadvantage of this system is the fact that the propeller blade has a laminated surface and the edges of the laminations on the working face of the blade are required to strike the air as the propeller is revolved, and there is danger of splitting them apart.

To overcome this objection, a molded propeller was designed and found considerable use abroad, as well as a certain amount of limited use in this country during the war. In this type of propeller the laminations are twisted to the proper form and then are cemented together so that the working face of the propeller represents an uncut surface of veneer. The method of forming these propellers is illustrated in the accompanying engravings. The layers of veneer are laid upon a block of wood shaped to the form of the working face of the propeller. Between the lower three wooden layers, that is, the ones adjacent to the working face, there is an interlining of linen. The layers are cemented with a glue made of casein and lime. This is mixed in a high speed churn just before using and has to be applied within fifteen minutes of the time it is mixed. The cement is applied cold. The laminations of the propeller are firmly clamped by means of wooden blocks as shown in the photograph. In this position, the propeller is allowed to set. The glue is of such a nature that it will not be affected by heat or by moisture. The propellers may be boiled for hours without showing any tendency for the laminations to separate. After the cement has completely hardened, the back of the propeller is shaped by hand, but the working face is practically untouched. The propeller is then given an impregnating bath to close the pores of the wood, and then pigskin rawhide is shrunk over the outer ends. The final operation is to varnish the propeller.



Stages in the construction of the molded propeller

By this means of construction it is possible to obtain a much narrower hub, and by setting two propellers at right angles, one to the other, a four-bladed propeller is obtained with a thickness of hub scarcely greater than that of the common two-bladed propeller.

The Current Supplement

THERE are vast expanses of country in South America that have never been visited by white men, and about which little or nothing is definitely known. One such region lies in the interior of Venezuela, and is inhabited by tribes of the Motilone Indians, who have been reputed, even from the times of the early Spanish adventurers, as the most warlike and dangerous of any of the inhabitants of the continent. Last summer an American explorer succeeded in penetrating this region, where he spent some time with the natives; and an account of his adventurous observations will be told in the SCIENTIFIC AMERICAN SUPPLEMENT, the first instalment appearing in the current issue, No. 2244, for January 4th, under the title of *The Macoa Indians of Venezuela*. The narrative is accompanied by a number of original photographs taken by the author. Many plants and flowers owe their brilliant colors to pigments about which scientists have but slight knowledge; but it has been discovered that these pigments serve other useful and necessary functions besides that of decoration. Some account of the subject will be found in a paper on *The Anthocyanin Pigments in Plants*. *The Oyster Feeds Both Man and Plants* tells how the shells of these popular bi-valves are utilized as a valuable fertilizer, and it is accompanied by a number of photographs. Another interesting paper is on *A Pitched Baseball*, which explains, and illustrates, the rationale of its many freaks. Other articles of interest in this issue include *Vibration: Mechanical, Musical and Electrical*, *Uniformity in Aerographic Records*, *Dyes in Photography*, *The Probable Trend of Aeroplane Design*, *Coal Gas for Motor Vehicles in England*, *Dangers of Explosion with Inflammable Vapors*, *Tree Wasps* and *The Relations of Light and Health*.

South African Geographical Society

THE South African Geographical Society, recently formed, contemplates a wide range of activities, and has already launched a magazine, the *South African Geographical Journal*. The society plans to establish a geographical museum and library containing commercial and industrial specimens from all parts of the world, besides books, maps, etc. It also proposes to promote "floating exhibitions," whereby samples of commodities may be brought to South Africa from other countries and samples of South African products sent abroad. Geographical education is to be fostered, and it is hoped to establish traveling scholarships.

Cementing the propeller laminations in the press

Removing the surplus wood from the back of the propeller

World Markets for American Manufactures

Edited by LYNN W. MEEKINS

A department devoted to the extension of American trade in foreign lands

The Adaptable French Soldier

IT has been proved more than once during the last four years that the French would rather fight than eat. But now that the "kamerad" chorus has ended the war, they have gone back to the farm and further glorified French soil by erasing shell-holes with plowed furrows from which bountiful crops will spring. Today the farms of France need implements and equipment of many kinds, from hoes to harvesting machinery.

The French Departments, or political divisions, are taking active measures to promote the "back to the land" movement. This is being done by offering attractive inducements to the young farmer. In the Department of the Loire, for instance, a minimum of from 20 to 25 acres may be allotted to each man not over 35 years of age who will promise to remain 10 years at the head of his farm. He will be supplied with about $200 worth of modern implements and loaned additional equipment not exceeding $400 in value, for which he has 15 years to pay. In order to encourage large families, part of this will be canceled according to the number of children born after the farmer has taken possession of his allotment of land. French mills and factories need workmen, but the actual restoration of the country is squarely up to the farmer, and agriculture has replaced military service as a patriotic duty.

Two Factors Limit the Market

The American manufacturer of implements and machinery, however, should not overestimate his opportunities for stocking French farms with his products. In the first place, French manufacturers, more familiar with the different kinds of soil in their country, are meeting with much success in turning out the equipment best suited to it. That the domestic makers are not going to let the United States run away with the trade is shown by a statement of the President of the Syndicate of Implement Manufacturers, who said that "if the Ministry of Agriculture will lay down a set program, we will undertake to furnish French machines corresponding to the type of American machine indicated as a model, and of equal quality at an equal price, even if we have to make sacrifices to do it." In the second place, the French Government has no intention of countenancing extravagance, and to prevent the competitive bidding that would result in it, all buying is closely organized.

The Paris representative of an American machinery corporation, who recently visited the United States, mentioned the "consortiums", or industrial associations, for importing various lines. The farmer who needs a harvesting machine applies to the consortium dealing in farm implements. If it cannot be supplied by a French manufacturer, the organization will import it, and the American manufacturer may sell it through this means.

Although the small tractor of about twenty horsepower will probably be the most useful machine on the French farm, the average size of which is considerably less than ours, there will be plenty of work for draft animals. Thousands of horses now being used by the American Army are likely to become available for use on French farms before the next harvest. Many parts of the country—the Bordeaux district, for example, with its many vineyards and small estates—are favorable for the introduction and sale of horse-drawn cultivators, harrows, plows and other implements. Most sections of France, though, are calling for tractors, and this is the line offering the principal opportunity to the American manufacturer.

Isles of Plenty

"IT'S good to see the sugar bowl on the table again!" remarked a prominent exporter at luncheon the other day. "Just think for a moment what that signifies. We are receiving more sugar from abroad, and the welcome ships that bring it can take more of our goods back to the sugar-producing countries, which are clamoring for them and have ample money to pay for them. With Cuba, nearby across the Straits of Florida, the United States is doing a vast amount of business; with the Dutch East Indies, far across the Pacific Ocean, we can build a large and profitable trade if we go after it. The latter market is of particular interest because it offers valuable raw materials—rubber, tin, vegetable oils and fibers—in exchange for all sorts of American manufactures. It is the world's third largest purchaser of cotton cloth; it needs considerable quantities of modern machinery for sugar plantations, for a rapidly growing oil industry, and for mining; and there is no limit to the prospect for the sale of medium-priced automobiles."

The Dutch East Indies are among our most distant customers, and our business with them can never be of the mail-order variety. Nevertheless, it is comparatively easy to trade with them because most of the important firms have opened branch offices in the United States to buy our goods and to sell theirs, as the respective lines are non-competitive. It is a great advantage to both countries to conduct trade in this way.

How Germany Obtained East Indian Business

The Dutch have always been among the world's great traders. Before the war both the Netherlands and its East Indian possessions dealt chiefly with Germany. The reason for this is obvious. Germany's railroads extend to the border of Holland; its waterways traverse that country. It is as simple for Germany to deal with Holland as it is for the United States to trade with Canada, and Holland, of course, controls the trade of its colonies, which have an area 58 times as great as that of the mother country and a population more than six times as large. American trade with the Dutch East Indies used to pass through Holland, but the war interrupted communication between the Netherlands and the East Indies, so that although the mother country continued to be dependent largely upon Germany for its imports, the colonies had to lean upon the United States and Japan, each of which has increased its exports to the islands about 300 per cent during the last two years.

American exporters did not seek this large volume of business. They failed to study the requirements of the market and they did not push their lines systematically, so the Dutch colonial merchants came to us, and it will be decidedly to our advantage to make them welcome.

Java a Market for Quality Goods

Commercially, Java is four-fifths of the Dutch East Indies. It is the logical trade center for the archipelago. Batavia and Soerabaya are the principal ports. Sumatra and Borneo, however, should not be neglected by the representative of an American firm visiting the islands. Although traveling expenses are high, averaging about $15 per day, the people of the Dutch East Indies want quality goods, and their patronage is well worth while. There is a particular demand for oil-mill machinery, the vegetable oil industry having become very important. Large extensions are proposed for the principal mills, which expect to increase their capacity from 135,000 tons of copra annually to 200,000 tons within two years. With iron ore deposits in the island of Celebes estimated at 350,000,000 tons, a fine opportunity is offered to American manufacturers of mining machinery.

The lack of an American merchant marine before the war enabled the Dutch to carry our shipments to the East Indies by way of Holland. With our own ships, and with the development of sufficient interest among American exporters, we can retain and add to our present direct commerce.

The "Shipment Sample" Is Important

One American firm has built a successful business with the Dutch East Indies in this way. A representative was sent to that territory with a full line of samples. He showed the colonial merchants just what his firm had to offer, and he received surprisingly large initial orders. In making shipment, the method of packing specified by each customer was carefully followed. Reasonable credit was extended. Because he was on the ground, the salesman learned of the value of the "shipment sample." This does not represent the goods to be shipped in the future, but it is taken directly from the actual shipment as it goes forward. When the consignment arrives in the Dutch East Indies, the goods are sold from the "shipment sample," while the goods themselves remain in the warehouse. Needless to say, endless difficulty is caused if there is the slightest difference between the "shipment sample" and the goods.

The president of one of the largest trading houses in Java recently arrived in the United States to make arrangements for the establishment of direct steamship lines between New York and the Dutch East Indies and between San Francisco and those colonies. He believes that the only two factors necessary for material advances in American-Dutch East Indian commerce are coöperation and ships.

American three-horse harvester used in France

Can We Sell Electrical Goods in France?

THE world's coal supply has been thrown out of gear by the events of the war, and the use of hydro-electric power has advanced rapidly. Electricity as a great labor-saving source will have much to do with the reconstruction of France and Belgium, and it would seem that American manufactures will be called upon for many electrical devices. An engineer who has made a close study of the French market for 25 years believes that material, if not radical, changes in their products must be made by American exporters who expect to dispose of their goods in France, where the methods of installation and the standards of quality are old-fashioned, to say the least. Ten years ago, this engineer said, there was not a single electrical wiring installation in France that would pass the requirements of the National Board of Fire Underwriters in the United States.

"American methods and materials make the cost per outlet prohibitively high," said a French importer, "and that is the principal obstacle to the sale of American electrical supplies. Because carelessness is not a national trait with us, the fire losses due to electrical installations in France are not one-tenth as great as the losses from similar causes in the United States, in spite of our crude devices, so we naturally think that such devices are good enough. If Americans will make simpler and less perfect appliances which will be cheaper to produce, thereby lowering the selling price, the French market offers good prospects. The cost is the chief factor."

This importer thinks that push-button switches of the American type would be regarded as luxuries, a cheap, rotating, single-power switch being favored for general use, and the English tumbling switch, retailing for about twenty cents, being employed in installations of higher grade. The modern cut-out box is unknown in France, where the average form of cut-out now used would probably not have been allowed in the United States even 15 years ago. The wiring of French fixtures is very inferior to American practices, iron or steel pipe conduits being unfamiliar to the French electrician.

If competent salesmen, familiar with France and with the French language, are engaged to conduct a carefully planned educational campaign, useful results may be accomplished in bringing before the French public the merits of American goods.

A Natural Derrick Mast

IN connection with the recent unpleasantness, it was found necessary, as pointed out in the public prints from time to time, to get out from the forests of the American northwest a great deal of lumber with the utmost haste. One lumbering concern in the state of Washington hit on an ingenious expedient for saving time with each change of location—doubtless an expedient that has been employed before, but never, we suspect, upon such a scale or in such a deliberate manner.

Wherever it was necessary to have a derrick, search was instituted for a tree sufficiently tall and sufficiently straight and sufficiently strong to serve as derrick mast. This was usually found, and was then worked up in the shape shown in our photograph. As anyone can testify who has watched the process of erecting the mast for a derrick of the first class, a good deal of time was thereby saved, to say nothing of the expense.

Using a big tree for a derrick mast

Growing Cotton for Tires

THAT an affinity should exist between automobiles and cotton seems unbelievable, but the fact remains that one of the largest tire manufacturing companies in the world has found it necessary to go into the business of raising cotton of a superior quality in order to insure an adequate supply to meet the increasing needs of its factory. That this is true is but another example of the complex nature of modern business, where one industry is vitally dependent upon another apparently as far removed as the poles. In the manufacture of automobile tires one of the chief requisites is long-staple cotton, a variety that is exceedingly valuable and hard to get. Until a few years ago none of this variety was produced in this country, and the entire supply had to be imported from abroad, principally Egypt. The present production in the United States is about 18,000 bales and the consumption is many times that, 65,000 bales being used by one company alone.

Some two years ago one large tire maker accordingly decided that it was necessary to embark in the cotton business. There was plenty of ordinary cotton raised throughout the South, but not the kind required in the manufacture of tires. For the latter it is necessary to have cotton whose fibers grow to unusual length, such as Sea Island and Egyptian varieties. To produce this long-staple cotton requires the continued observance of a number of conditions usually beyond the power of any one grower to maintain. It requires community growing to insure an adequate supply of pure seed, to keep out weed and insect enemies, to turn out from the gin a smooth sample without defects, and to establish a reputation for a consistently high quality of cotton. The principal advantage which the Egyptian growers have over those of other parts of the world is that they have absolutely definite standards or grades, which are known all over the world and which can be depended upon by all buyers to come rigidly up to specifications.

Having determined upon the enterprise, the tire company, after investigations, decided upon the Salt River Valley, in Arizona, as the scene of their operations. Here climatic conditions were favorable, an abundant water supply was assured by the great Roosevelt Dam nearby, and a sufficiently large acreage was available to insure the satisfactory working out of all necessary details. Some of the 35,000 acres acquired had previously been cropped to alfalfa but a large portion was virgin desert which had to be reclaimed. A water system designed to reach every portion of the property is being installed and the land is planted to cotton as fast as it can be prepared. Thirteen hundred men are employed in construction work, and two model towns are being built to accommodate the thousands of workers who will be employed in the fields when the project is completed. Five gins have been erected to handle the product, and it is the intention of those in charge of the work to utilize every portion of the cotton plant. The lint will be used in the manufacture of tire fabric, the seed will be crushed for oil and the by-products fed to stock. It is thought that even the stalks can be utilized in the manfacture of a substitute for paper pulp.

The Salt River Valley project will be a coöperative one in every way. The company will partially finance local settlers who engage in cotton raising under the prescribed conditions, and will provide for the marketing of the product. The continued production of a crop with a fixed high quality of fiber is a big problem and requires the coöperation of the grower, the ginner and the banker. The grower alone cannot effect the stabilization of the cotton industry in his community. The ginner must devote his mill exclusively to the ginning of long-staple varieties, as otherwise pure seed and a uniform fiber cannot be maintained. The banker must help because he must stand ready to lend his money to the producer during the long growing season. Furthermore, each grower must use every effort to keep out of the district the plant diseases and enemies so prevalent in ordinary cotton districts.

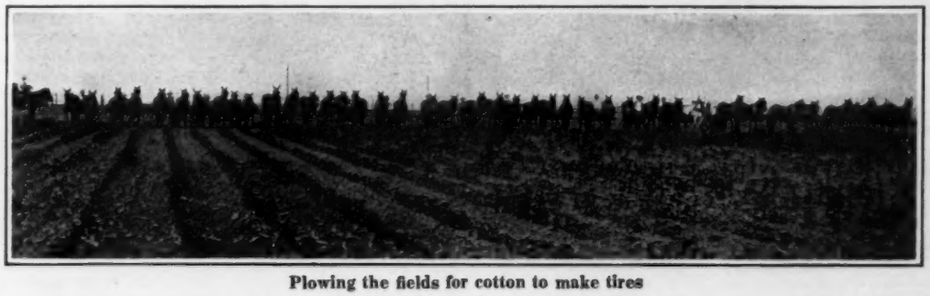
In staple and quality of fiber the American-grown cotton is comparable with the best varieties produced in Egypt. In both countries the cost of production is about the same, for what the Egyptian saves in labor cost is made up by the American in the utilization of labor-saving machines. The crop producing capabilities of the land are about the same in each case. A good production is a bale an acre, worth from $150 to $200. One of the great difficulties confronting the growers of the long-staple cotton in this country is to secure an adequate supply of pure seed. At the present time the supply is much below the demand and prices are higher than at any time in the history of the cotton industry.

Egyptian cotton in length of staple is intermediate between average Sea Island and average Upland (ordinary American) cotton. It has, however, certain characteristics which cause it to be in demand even in the United States, where, during recent years, Egyptian cotton has comprised about 80 per cent of all imported cottons. These special qualities are its fineness, strength, elasticity and great natural twist, which combined enable it to make very fine, strong yarns, suited to the manufacture of the better qualities of hosiery, for mixing with silk and wool, and for the making of lace. It also mercerizes very well.

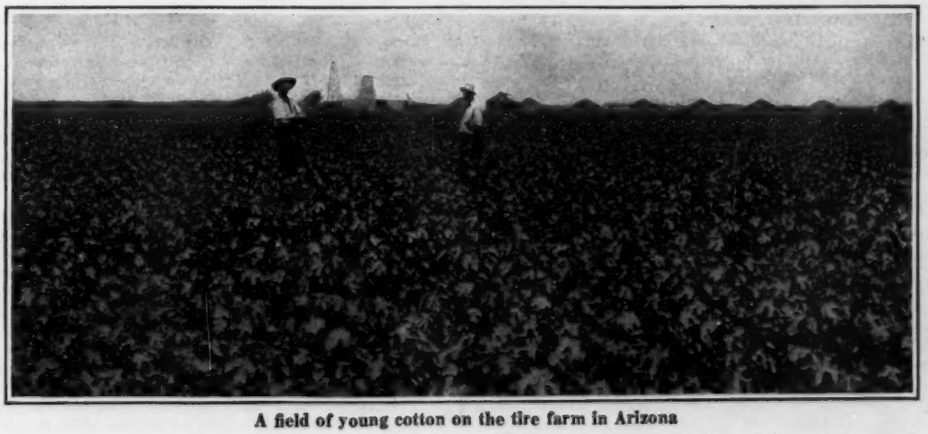
Climatic conditions in Egypt differ radically from those existing in the cotton belt of the United States, but closely approximate those obtaining in Arizona and in southern California. The rainfall in Egypt is very small and is quite insufficient for the needs of the plant, very little rain falling in the Nile Delta during the growing season; yet Egypt stands third in the cotton producing countries of the world. Elaborate irrigation works supply the cotton fields with the necessary water, and this condition is almost duplicated in the long-staple districts of the Salt River Valley and the Imperial Valley in this country. The area devoted to cotton in Egypt is about 1,800,000 acres and nine-tenths of it is in the Nile Delta. The delta soil is typically a heavy black alluvial clay, very fertile but difficult to work. The soil in the cotton districts of Arizona is, in many respects, similar to that of Egypt; and with climatic conditions, irrigation, type of soil, and other elements needed for successful cotton growing, almost identical with those found in Egypt, there is no reason why the United States should not be able to produce all the long-staple cotton it consumes, within its own borders.

Aside from the cotton raised, the utilization of the by-products obtained from the cotton seed, will greatly add to the financial returns of the growers, as a variety of valuable products are now obtained from the seed. For every pound of cotton produced for the market there are two pounds of cotton seed. Until a few years ago these seeds were considered as worthless and the problem of their disposal was a trying one. In the vicinity of every gin were huge piles of cotton seed, left to rot and produce an offensive odor. Some of it was used to fertilize the fields, but the great bulk was dumped into streams, burned, or otherwise wasted. But this is all changed now. The seed is either manufactured into vegetable oils and stock foods, or if it is left on the plantations, it is entirely utilized as feed for stock or for fertilizer. An analysis of ordinary Upland cotton seed shows that it is rich in nitrogen, phosphoric acid and potash. The Egyptian cotton seed is even more valuable for its chemical constituents. Compared with commercial fertilizers, it is estimated a ton of cotton seed is worth at least $10.

The best grades of cotton seed oil are used as a substitute for olive oil or lard and the poorer grades are employed in the manufacture of soap, candles and phonograph records. Recent experiments have shown that flour made from cotton seed, when mixed with wheat, makes a palatable and nutritious bread. Cotton seed meal or cake is one of the most valuable of stock foods, and it has from three to four times more proteins, about twice as much fats, and seven times as much ash or bone material, as corn or oats. Even the cotton seed hulls which remain after the milling process are utilized in feeding stock, and in the vicinity of the big mills of the South it is customary to find large establishments for the feeding of thousands of head of stock for market.



Plowing the fields for cotton to make tires



A field of young cotton on the tire farm in Arizona

The Heavens for January, 1919

A Group of Stars of Extraordinary Proportions

By Professor Henry Norris Russell, Ph.D.

WITH the opening of the new year men of science, like all others, are gradually settling down to their old pursuits and occupations; but it will be several months before this return to work is reflected in an increase in the now diminished volume of scientific papers; and one who, like the writer, gets an opportunity to look over the current literature only at longer intervals than usual, still finds himself surprised at the small amount of new material that comes in, month by month.

This is very much as it should be, at the close of this overwhelmingly eventful year. Yet on second thought it is remarkable, not how little has been added to astronomical literature, but how much. And while this is true of the United States, it is still more conspicuously so in England. The number and the high quality of the papers which have been published by the Royal Astronomical Society of London, during this fourth year of the war, are truly amazing. In fairness to our defeated foes we must recognize too, that astronomical work of real value and considerable amount has been done in Germany during the same interval (and transmitted to the outside world through the good offices of Danish astronomers).

Even astronomers of France and Belgium, driven from their observatories and their homes by the fury of invasion, have (when unable to take up arms in defense of their country) found asylum in England or America and continued to carry on researches of the most excellent quality. But the matter of which we may well speak more particularly this month is the work of a neutral—and probably the most distinguished of all astronomers in neutral countries—Professor Kapteyn of Groningen in Holland.

In a series of admirable papers published in the *Astrophysical Journal*, this master of stellar astronomy has discussed, with great fullness and ingenuity, the stars of the "helium type" which are situated in the part of the heavens that includes the constellations of Canis Major and Orion. He has determined their distance, their true brightness, and their motions in space. This problem was more difficult in this case than in that of the stars in Centaurus and Scorpio, which he handled some years ago, for this time he had to deal with a group of stars which are moving almost straight away from us, and therefore appear to be standing almost still in the sky.

The more obvious methods applicable to a group of stars with easily recognizable proper motion were therefore, not at his disposal; and it was only by a very ingenious combination of all the available data that Professor Kapteyn finally reached his goal. Complete success has at last crowned his efforts, and at the end of his monograph he gives a table of his results which amounts to a statement of the distance and true brightness of each of more than a hundred stars. The bulk of these stars are likely to be of interest mainly to the technical student; but the conclusions regarding the distances, and so on, of the brighter ones are certainly of general significance, and may well be retailed here.

Some Startling Figures

The group under consideration includes all the conspicuous stars of Orion, except the ruddy Betelguese, together with almost all those of Canis Major except Sirius. It has long been realized that these stars were remote and very brilliant objects; but the actual figures are decidedly impressive. Beginning in the northern part of Orion, and picking out the bright stars, we find that Gamma Orionis (in the giant's shoulder, as he is depicted on the old star maps), is at a distance of 370 light years, and gives out about 2,100 times as much light as the Sun. The neighboring star Lambda Orionis is farther off (450 light years) and, though not very conspicuous to the eye, is in reality 500 times brighter than the Sun.

The three stars of the belt are still more distant. With many others in the vicinity, they belong to an unmistakable cluster of very white and hot stars which centers itself upon the Great Nebula of Orion, and is therefore called by Kapteyn the "Nebula Group." The average distance of this group, and doubtless of the Nebula itself, is 600 light years. Even those stars of the cluster which appear faint to the naked eye are great suns. Thus Sigma Orionis (close to Zeta and below it) is 800 times as bright as the Sun; Eta Orionis (below and to the left of Delta), gives out 1,000 times the Sun's light; and Iota Orionis, just below the Nebula, is 2,200 times as bright as the Sun. The three stars of the belt are brighter still, Delta being 3,000 times the Sun's luminosity, Zeta nearly 4,000, and Epsilon, the middle one of the three, reaching the prodigious brilliancy of 6,000 times that of the Sun.

Kappa Orionis, in the lower part of the constellation, is 520 light years away, and 2,600 times as bright as the Sun. Beta Canis Majoris, which to the eye seems so small compared with its neighbor Sirius, is 450 light years away—more than 50 times the distance of Sirius—and 2,400 times as bright as the Sun, or 100 times more luminous than Sirius, which owes its preëminence in our skies purely to the accident of proximity.

There are several very bright stars in the group below Sirius, the brightest, Epsilon Canis Majoris, being nearly 600 light years away and 5,500 times as bright as the Sun. But the leader of all this starry host is Rigel, which, just as it appears brightest to us, is so in reality. The estimated distance of this enormous star is 420 light years, and the resulting figure for its luminosity is 12,000 times the brightness of the Sun. This makes it by far the brightest star of which we have definite knowledge—Epsilon Orionis and Epsilon Canis Majoris coming next, and then Antares, which is about 3,500 times as bright as the Sun. By this we do not mean to say that Rigel is the brightest star in the heavens, but only that it has not yet been possible to determine the distance, and hence the brightness, of any brighter star. Alpha Cygni may be as bright, or brighter, and it is rather probable that Canopus is brighter still; while some of the Cepheid variables of unusually long period, according to Shapley's work, may also belong in this class.

But a star 12,000 times brighter than the Sun is an extraordinary enough affair. It is hard to realize what the figure actually means. Perhaps the best idea can be obtained by those who are familiar with Rigel as a telescopic double star. Ten seconds of arc away from this star is a companion which, even in a fair-sized telescope, looks like the tiniest dot of light beside its dazzling primary, which exceeds it some 300-fold in brightness. Yet even this inconspicuous attendant is *30 times as bright as the Sun*, and nearly twice as bright as Sirius!

The physical conditions which prevail in such a remarkable object encourage lively speculation. From the spectrum of the star, which is of the type called B8, and indicates a surface temperature a little higher than that of Sirius, but not nearly as hot as the stars in the belt—from this it may be estimated that Rigel gives out perhaps 20 times as much light per square inch as does the Sun. If this is true its surface must be some 600 times as great as that of the Sun, and its diameter about 25 times that of the Sun, or a little more than twenty million miles. This would make it bulk about 15,000 times as large as the Sun. What its mass may be we can only roughly guess; but according to the latest investigations, its great brightness would indicate an unusually great mass. One hundred times the Sun's mass might not be an unreasonable figure. This would make its mean density 1/100 that of the Sun, or about seven times the density of ordinary air.

Though these figures are professedly little more than guesses, they probably give a fair idea of the nature of this amazing object—a huge ball of gas, fairly dense at the center, but highly rarefied at the edge, and furiously incandescent, even to its very outer limit, to a degree which we can hardly conceive. In front of such a star, and viewed by eyes capable of bearing its brightness, our Sun, so dazzling to us, would appear like a small black spot.

At 11 o'clock: Jan. 7.
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.

At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

At 9¼ o'clock: Jan. 29.

NIGHT SKY: JANUARY AND FEBRUARY

The Heavens

Orion, with the glorious stars of which we have just spoken, is now full south, high in the heavens, and displayed in his full effulgence. Canis Major is below, with Sirius apparently far outshining the vaster orbs which lie in the depths of space beyond.

Canis Minor is on the left of Orion, and Gemini is above. Leo is well up in the East—Saturn being close to his brightest star, Regulus, so that the two look to the naked eye almost like a double star—and Hydra rises in the southeast. Ursa Major is coming up in the northeast; Draco and Ursa Minor are below the Pole, while Cepheus and Cassiopeia are descending in the northwest.

Pegasus has just set, but Andromeda and Aries are still well up in the west. Perseus is higher; then Auriga, right overhead. Taurus is very high in the southwest, with Eridanus and Cetus below.

The Planets

Mercury is a morning star all through January, but is best visible in the early part of the month, about the time of his greatest elongation, which occurs on the 7th, when he rises about 5.40 A. M. Though 23 degrees from the Sun, he is almost as far south of the equator, and is consequently ill-placed for our observation.

Venus is an evening star, and is slowly coming into view in the twilight. By the end of the month she sets at 6.30 P. M., and is conspicuous just after dark.

Mars is an evening star in Capricornus and Aquarius, setting at 7 P. M., in the middle of the month. He appears as a reddish star of the second magnitude, and is brighter than any fixed star in the vicinity.

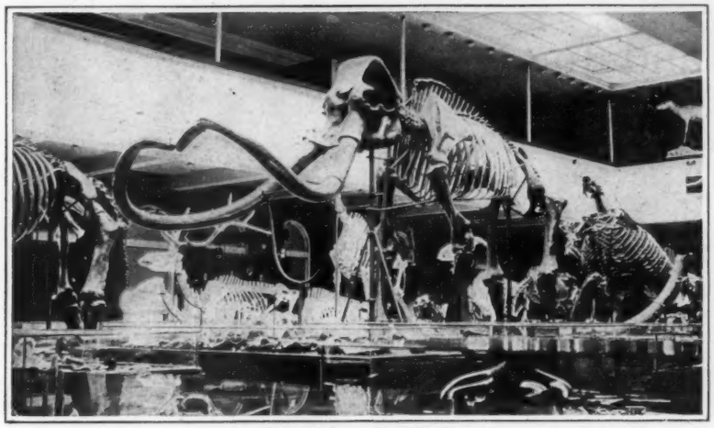
Jupiter is in Gemini, and is visible all night long, being in opposition to the Sun on the night of January 1st. He is a splendid object, twice as bright as Sirius.

Saturn is in Leo and rises at about 8.40 P. M. at the beginning of the month. At this time he is about 2 degrees northwest of the bright star Regulus, which he much surpasses in brilliancy. During the month he moves about 1½ degrees farther west, and by its close he rises at 6.30 P. M.

Uranus is an evening star. On the 22d, he is in conjunction with Mars, being 22 degrees north of the latter.

Neptune is in Cancer, and comes to opposition on the 28th, but is observable only with telescopic aid.

The Moon is new at 3 A. M. on the 2d, in her first quarter at 6 A. M. on the 9th, full at 4 A. M. on the 16th, in her last quarter at 11 P. M. on the 23d, and new again at 6 P. M. on the 31st. She is nearest the Earth on the 11th, and farthest away on the 23d. She passes near Venus on the 2d, Mars on the 4th, Uranus on the 5th, Jupiter on the 14th, Neptune on the 16th, Saturn on the 18th, and Mercury on the 30th.



A skeleton from the fossil mine

The tar pit in which California's extinct fauna is recorded

California's Fossil Mine

CALIFORNIA is indeed a land of wonders and extremes. Not the least of its sights, though by no means the best known, is the asphaltum bed six miles west of the heart of Los Angeles, where for countless ages have been preserved the bones of thousands of animals, most of them prehistoric in their origin. Various names have been given to these beds—the La Brea Beds, the Fossil Gardens, the Hancock Brea Deposits, the Death Trap, the Pit, the Bone Field, and half a dozen others.

The deposits are by no means of recent discovery; they have in fact been known for over a century. The earliest record found is that of the Mission fathers, who, writing in 1769, state that the tar was used for calking the boats and for roofing. Later the natives and the settlers of the region employed it for roofing, for fuel and for paving, and in Los Angeles the roofs of some of the first adobe houses were covered with the asphaltum brought from La Brea springs. At various times during this period bones were reported to have been found, but it was supposed that these were only those of the ranch animals; in fact, this was the opinion of no less an authority than the State Geologist in 1865.

When the holders of the title under the original Spanish grants sold the property to American interests, it is interesting to learn that the curious little tar springs appearing at various places on the ranch were considered injurious to the property. It was not then dreamed that the whole region was rich in petroleum, or that scarcely a mile to the north were to be located some of the richest oil prospects of all time.

After the Civil War the demand for tar rose, and soon carloads were dug from these beds and sold; but so many bones were found mixed with the tar that the market for it ceased. The big hole left by the digging soon filled with water and tar and oil, and a lake was formed. Gas bubbles can always be seen breaking on the surface of this lake.

As early as 1875 the deposits were recognized as prehistoric, and a selection of bones identified as those of an extinct species of tiger. But it was not until 1908 that the work of excavation began. In June of that year, Mrs. Erskine M. Ross, then owner of the ranch, gave the Southern California Academy of Sciences the privilege of excavating fossils. From that time on, several schools and scientific foundations were accorded similar privileges for a certain number of months. Many of the fossils were placed in the museum at Exposition Park in Los Angeles, where they are on public exhibition. The bones as dug out are invariably in an excellent state of preservation, the oil having penetrated them thoroughly.

The animals that fell victims to this perpetual, silent death trap represent all geologic ages from the Pleiocene down to the present time; the trapping of unwary animals is in fact going on all the time. The best authorities tell us that the tragedies took place somewhat after this fashion:

The outpourings of the tar springs often formed pools or even streams which, as the dust and gravel carried by the prevailing west winds settled and became mixed with the tar, acquired all the appearance of a hard surface. Sooner or later rain would fall and collect on the top. It was then that the unwary elephant or saber-tooth tiger or camel or bird, seeing the water, came to drink. Not until the victim tried to leave the miry pool did he discover himself to be trapped. The more he then struggled, the more firmly imbedded he became; until finally he was unable longer to move. In a short time he sank deeper and deeper in the soft tar, until after a few days he was completely lost to sight. As this process has gone on for ages, many animals of every conceivable description—bears, condors, saber-tooth tigers, elephants, the giant sloth, bison, peacocks, and a host of birds and smaller quadrupeds—came to be embedded here almost in a solid mass of bones. As late as the '80s colts were known to have been thus lost in the mire, and skunks and birds are trapped there today. In fact, the pits may be said to constitute a natural mausoleum, in which is preserved a long and graphic record of the animals that have inhabited Southern California through past ages of geolgic time.

So nearly do the fossils found here represent some of the present-day African and Asiatic species that some scientists are inclined to accept them, if not as proof, at least as evidence that these continents were at one time connected with the American continent. Be that as it may, the beds and the fossils from them will always be of prime interest to the student of natural history, paleontology or geology; and so far as can now be seen, there exists here an inexhaustible storehouse of relics of the past.

Stealing the perfume from a dish of flowers

[illegible] guard whose eggs are worth more than those of the hen

Simple Perfume Making

FEW people know how easy it is to capture the fragrance of real flowers. The first step in the plan is to secure a glass funnel. The small end of this instead of opening should be drawn out to a fine point. Some means must be adopted to maintain the funnel in an unright position. A little stand made of wooden uprights and wire is shown in the photograph. Any kinds of highly scented flowers, such as roses, may be gathered; these should be in fresh condition as, just after opening, the fragrance is at its best. Place these in a vase filled with water so that they will not wither. Now get some ice and crush this into small fragments using it to fill up the glass funnel. At the same time place some receptacle under the funnel. Sprinkle salt on the ice and then move the flowers and the funnel into close proximity.

After a while it will be seen that the moisture from the atmosphere is condensed on the outside of the funnel, the surface of which is chilled by the ice. The ethereal odor of the flowers combines with this liquid which slowly trickles down by drops into the receptacle. When a sufficient quantity is secured this may be mixed with about an equal quantity of pure alcohol. The mixture should then be placed in bottles when it will keep for an indefinite time. In this way all kinds of flower perfume may be captured with the greatest ease.

The Water Monitor

THE Water Monitor, *Varanus salvator*, is one of the standbys of the citizens of India, Ceylon and the Malay Peninsula and Islands, and thereby hangs a tale. You might shudder when you suddenly confronted one in the jungle. Not so the native, hunting its eggs and rejoicing to get near such treasures. The Monitor is equipped with a long forked tongue, extending from a sheath like a snake's. It is one of the largest of existing lizards, reaching a length of 7 feet, although its nearest relative, the gigantic Australian Monitor, grows from 12 to 30 feet long. The Monitor lays twenty or more white, soft-shelled eggs in hollow trees, and in Burma these bring a much higher price than hen's eggs.

The Monitor is well fitted for its life. It is a swift runner, able to overtake the speediest mammals, frogs, turtles and snakes on which it feeds. It often startles hunters by crashing through the jungle, making as much noise as large game. It climbs trees for squirrels, birds and their eggs. At other times it may be found digging along stream banks for the eggs of the crocodile, of which it is most fond. Either in running or swimming, it can leave its enemies far behind. If surprised when up a tree, it drops into the water, swimming with powerful strokes of its flattened tail, which acts as oars and rudder. When being captured, it fights with teeth, claws and tail.

The natives term the Monitor, "Kabara-Goya." Although it is harmless and non-poisonous, it is used to produce deadly poisons. The Singhalese are experts in brewing a deadly poison termed "Kabara-tel." They extract poisons from venemous snakes, adding arsenic and other drugs, boiling the combination in human skulls. And here the Monitor comes in as a part of their superstition. They tie three monitors on three sides facing the fire. Then they torment the Monitors with whips and make them hiss to cause the fire to blaze up. You and I would take a bellows for this purpose, but the natives believe that the hiss of the Monitors adds to the poisonous quality of the deadly brew.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Adjustable Cutter for Making Large Holes in Metal

THE time required to cut a hole 1½ to 5 inches through iron or steel plate is about two hours by the old-fashioned use of a hammer and cold chisel. In efficient contrast is the use of a specially designed cutter which its makers say

For a quick hole in a sheet of metal

can do the same task in five minutes, a most valuable saving of a workman's time. The cutter is small and easily transported for work away from the shop and is adaptable not only for the cutting of iron and steel but also for other metals, slate, insulating fiber, asbestos board, linoleum, auto bodies, boilers, tanks and cabinets.

The cutter is adjustable for making holes of various sizes. All that is necessary is to drill a 3/16-inch pilot hole through the material, through which the stud of the cutter is passed and held in position by a flange nut. A few operations of the ratchet wrench quickly moves the cutting tool around the circumference of a circle of the desired diameter and a neat hole results in a few minutes.

Device for Handling Hot Metal

AN American company has recently perfected a unique liquid-metal car for use in charging large steel furnaces with hot blast-furnace metal. In the modern processes of making steel, it is now customary in the largest plants to put hot metal in open-hearth furnaces together with cold scrap steel and melt the two down and refine them into steel. It is not easy to transfer this hot metal into an open-hearth furnace but this new device renders the operation much easier.

It consists of a short-pour ladle with the necessary tilting mechanism and a motor-driven charging spout mounted on an all-steel frame. The capacity of the ladle shown is 35 tons, but it can, of course, be built to carry any desired capacity.

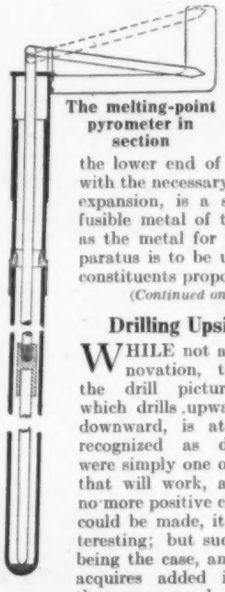
After the ladle car receives its load of liquid metal from the mixer, blast furnace or a larger ladle, it is taken to the charging floor of the open-hearth plant by a locomotive or motor-driven truck and run on a track directly in front of the furnace. The motor-driven charging spout is then driven into the furnace and the ladle tilted, the power for this being supplied by a motor and train of gears driving the drum, which takes up two chains attached to an equalizing bar connecting with the tilting lug of the ladle.

Short-pour stands mounted on the car frame enable the ladle to rotate, maintaining the axis of the pour on a line with the pouring spout of the ladle. In this way, it is pointed out, the pouring spout is kept close to the receiving runner during the whole pouring operation thus confining the metal to a short drop into the trough while the portable charging spout and ladle crane generally employed are eliminated.

A Simple and Efficient Pyrometer

IN the early days of the war in England, so great was the demand for steel and so scarce was skilled labor that unskilled men and women had in many cases to be used in foundry operations which could be done successfully and accurately only by the use of pyrometers. So complicated are many of these instruments and so difficult to make in a hurry that it was found necessary to devise a simple type for immediate use and one that would meet all the essential conditions. Recognizing these facts, two Englishmen, W. R. Barclay and G. E. M. Stone, worked out an instrument of decidedly novel design to meet the requirements.

The apparatus consists essentially of an outer tube of fused silica closed at its lower end and open above. Inside this tube is a rod, the lower portion of which is made of fused silica and the upper portion of metal. The top of this rod is pivotally connected to a pointer having its fulcrum on an upstanding lip at the



The melting-point pyrometer in section

edge of the tube, and terminating at a scale beyond that fulcrum.

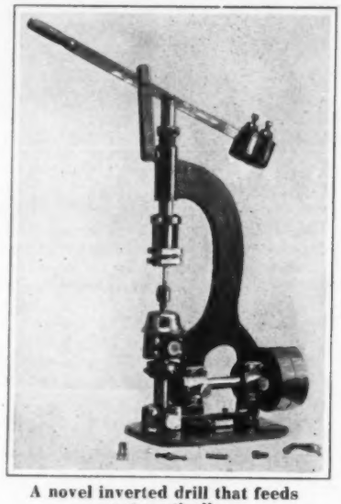
Turned to fit into the lower end of the tube, but with the necessary allowance for expansion, is a small piece of fusible metal of the same alloy as the metal for which the apparatus is to be used, but with constituents proportioned so the

(*Continued on page 19*)

Drilling Upside Down

WHILE not an absolute innovation, the design of the drill pictured herewith, which drills upward instead of downward, is at least to be recognized as daring. If it were simply one of those things that will work, and for which no more positive claim than this could be made, it would be interesting; but such is far from being the case, and it therefore acquires added interest from the numerous advantages which its manufacturers bring forward as the main features of their apparatus.

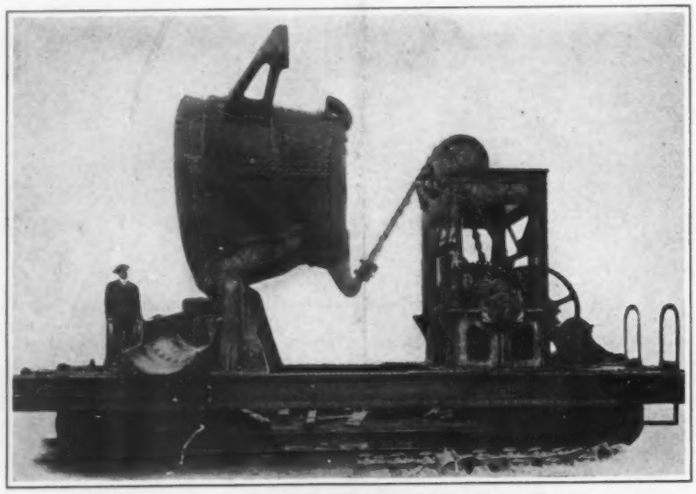
It was designed, in the first place, by a practical metal worker, for the purpose of chewing up tons of old castings in his



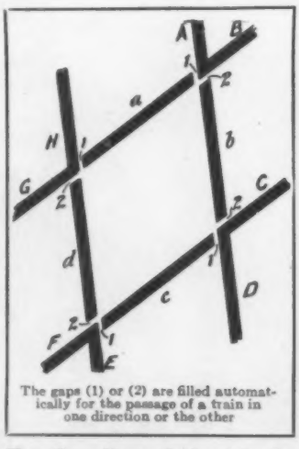
A novel inverted drill that feeds automatically

own shop; but it was so successful that the more finished model illustrated was brought out for commercial development. The "drill upward" principle is claimed to effect a 50 per cent increase in the speed of operation, since the borings drop out freely and leave a clean hole for the drill to work in. Aside from this, perhaps the best thing about the drill is the automatic weight feed—which is adjustable as well as automatic. In a word, the diagonal arm at the top of the machine acts, under the push of the weights seen at its lower end, as a lever bar that forces the work down over the drill. All that the operator has then to do is see that the work is properly placed; so he can operate from six to eight spindles without difficulty. In this connection, another valuable feature is the spring cushion at the top of the spindle, which takes up the blow when the drill breaks through, and thus saves much drill breakage.

This gang drill is intended for use on cast-iron, steel and brass articles which can be put through at the rate of 7,000 to 10,000 pieces per day. As a "speed-up" agency in the machine shop its makers insist that it is hard to beat.

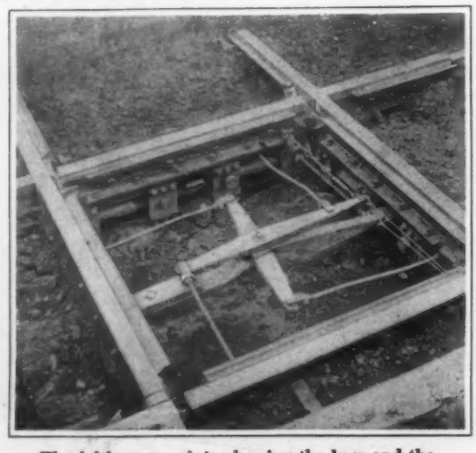


An effective liaison between the blast furnace and the steel hearth



The gaps (1) or (2) are filled automatically for the passage of a train in one direction or the other

How the rails are laid out for the new crossing



The jointless crossing, showing the lugs and the mechanism that operates them

A Shockless Railroad Crossing

A SHOCKLESS railroad crossing has been in use for several months on a branch line of the Southern Pacific in Los Angeles. It is so devised that the opening at each of the four frog points of the crossing is avoided, thereby doing away with the pounding or jumping of the wheels.

At each of the four points formed by two intersecting lines of track, instead of the old style frog all laid in one piece, only the two outer rails (A, B, C, D, etc., in our diagram) are joined together; and with them the continuity is complete—there is no depression or gap, but the entire rail top from both directions runs right out to the vertex of the angle. The quadrilateral is then completed by four short rail sections laid between the four angles, but in

(*Continued on page 19*)

Where Nothing Goes to Waste

(Continued from page 6)

operation and which proved most effective in the method of patching. There are employed here 341 persons, principally women. The harness department repairs all the old pieces of harness brought in from the battlefields; after being sorted out, the French harness is returned to the French army and the British harness to the British army. The chief items are complete sets of harness, of which about 1,000 are turned out weekly, and saddles, representing about 700 weekly. Some 150 women and 50 men are employed in this work, and the value of the monthly production amounts to $215,453. In the canvas department are handled leggings, haversacks, canteen covers, cartridge belts, medical packs, waist belts and other small equipment articles, and it turns out daily 5,000 canvas articles and about one carload of burlap sacks. Its production in a month equals about $222,878 in value.

The total output for the month of August was over three million dollars ($3,246,588), while the cost of production was $315,013; the percentage of cost as compared to the value of output was 10¼ per cent. The actual salvaging operations of the depots started last January with five officers, six enlisted men and six civilian employes, while at present about 10,000 persons are employed. The results show that the plant is not only saving a large volume of transport, but over $100,000 per day; and while the coming of peace curtailed the operations of the plant in all metal lines, there is little occasion as yet, for it to abridge its other activities.

Our Giant Aircraft

(Continued from page 7)

ideal landing places for seaplanes and flying boats.

To say that the N. C. 1 is the largest airplane in the world is to overlook what the other countries are doing. The Italian constructor, Caproni, is known to be hard at work on giant triplanes, one of which is said to exceed seven tons in lifting capacity. The Germans, during the past year, developed their Gotha-Lizenz long-distance bomber, with a wing spread of 140 feet and a lifting capacity of perhaps five tons or more. This German bomber is equipped with four powerful engines. The British have developed a still larger Handley-Page bomber with four instead of two engines, which has already carried more than 40 passengers in recent tests.

All the late belligerents are now at work on large planes, because they realize that only the very large planes have a real commercial value. The pursuit or chase planes—single-seaters capable of developing high speeds—have little or no commercial value. The two-seater reconnaissance and general utility military planes are available for mail carrying, and light express service. But the giant planes can be used for passenger transportation and for handling express and freight, when speed is essential.

So it is that all aircraft constructors are bending their energies toward large aircraft, and it may be a matter of only a few months before passenger-carrying planes are ready for business in this country and abroad, and the Atlantic will have been bridged by some form of heavier-than-air machine.

Iron That Can Be Whittled

IT is well known that rapid cooling of hot metals hardens them. That the opposite is true has recently been demonstrated in striking fashion by the General Electric Co. One of their scientists annealed American ingot iron surrounded by hydrogen gas for three hours at a temperature above 1,600 ° F. The product was very little harder than the softest copper, and can be whittled with a knife.

A Simple and Efficient Pyrometer

(Continued from page 16)

melting point corresponds to the temperature at which the metal in the crucible should be poured. The silica rod rests upon this piece of metal, and when so resting the pointer is in the zero position.

When the time has arrived for ascertaining whether the metal is ready for pouring, the pyrometer is lowered into the crucible of molten metal. It may be here explained that it is necessary to coat the portion of the silica tube which enters the crucible with a special covering to resist the cutting action of the slag and the reaction of the metal in the crucible. When the requisite temperature has been reached, the metal in the tube will melt and thus allow the rod to descend, by gravity, until its end rests upon the bottom of the tube. In so descending it raises the pointer in the quadrant to the position shown in the dotted lines, thus indicating in a positive manner that the crucible charge is ready for pouring. The pyrometer is then withdrawn from the crucible, and in order to prevent its metal charge from solidifying round the rod, the outer end of the pointer is depressed until it is forced by a spring catch into a recess in the bridge-piece, lifting the rod clear of the metal. When the latter has set, it is merely necessary to release the pointer and the apparatus is again ready for service.

It may be noted that a special socket connection has been devised to join the metal and the silica portions of the rod, in order to prevent the latter from becoming separated when the metal socket expands with the high temperature. The connection consists of a socket having a number of slanting saw cuts formed in its sides. The silica rod is fitted into the central recess and rammed in with cement, the arrangement being such that the saw cuts allow for expansion without relaxing the hold on the silica rod. In the event of an accident, such as the bottom of the tube falling out while in the crucible, the charge is not spoiled, as the fusible metal being the same class of alloy as the charge does not have any deleterious effect on it.

A Shockless Railroad Crossing

(Continued from page 16)

every case leaving a gap in the rail tops between the end of the inner section and the intersection of the outer rails. These inserted rails are marked in the diagram with small letters a, b, c, etc. Thus in neither direction is there a line of continuous rail.

The idea of the device is to provide, at the approach of a train on either line, a continuous rail on that line. For this purpose there is a lug or filler at each of the eight gaps, so arranged as to take either of two positions—up, filling the gap in the rail, or down, leaving the gap unfilled. These eight lugs are connected with each other by the operating mechanism, which can be set up to operate in either of three ways.

In any event, there is a base casting, upon which the rails rest. On each side of this, a few inches from the bottom, is a three-inch shaft carried in boxings, and on the ends of each shaft are found the lugs. Under the first system all the lugs are upright, and there is a full rail in each direction, all the time. The flange of the wheel, as it meets the lugs opposing its passage, pushes them forward; after each wheel has passed they return to their upright position. The other four lugs furnish the rail surface for the wheel—a surface without interruption, and which can accordingly be traversed without jar.

This automatic system is of course not at all feasible for fast trains; so for mainline use a block system has been devised for operating the crossing. Under this system the cross bars from cam to cam are removed. One of these is inverted and fastened to the base casting, and in the center of this bar is fastened a three-armed device and a straight bar, the ends of which correspond with the short lugs on the axles to which the upright lugs are attached. Strong lugs connect the short lugs with the bars in the center. When the upright fillers afford a full arm in one direction, the other lugs are down. At a convenient connection, wire pulls are attached to the ends of the armed device in the center and carried to a lever at any convenient point. When operated, one set of lugs or fillers rises while the other drops. Operation may be wholly automatic, by connection with the regular signals indicating which of the intersecting lines is clear; or the crossing signalman may be required to set the track separately from the signal for the passage of a train in one direction or the other.

When desired, the crossing can be operated electrically instead of mechanically. For this purpose, the ordinary mechanism used for operating switches from the block system may be employed, using selenoid pulls to move the lugs into position.

Farm Trademarks that Bring Business

ALWAYS a trademark is worth having, and when it is "catchy" and particularly appropriate for the products sold, it is of especial value. To this remark the business of agricultural production affords no exception. An eastern farm, famous for its poultry, and which has extensive apple orchards, adopted an attractive distinctive name that combined these two products in a single coined word, which was illustrated, cartoonwise, by an appropriate design. This mark, in varied sizes, is employed wherever opportunity permits—on letterheads, envelopes, billheads, selling literature, carton labels, etc. It is a striking thing that is seldom forgotten by those who see it.

Progressive farmers, who long ago realized the value of a good farm name, are now adopting trademarks freely; and where the farm advertises, or sells direct to the consumer by parcel post, the money-making possibilities of the device are so great that pains should be taken with it. Coined names, like that alluded to, have particular value. For while a poorly coined name simply sounds silly, a good one has enormous pulling power; and it offers the additional advantage that it can be registered in Washington and ownership and sole right of use thus guaranteed. The head of one of the great biscuit companies is said to have appraised the coined name under which his leading product is sold at a million dollars. Every reader is familiar with nationally advertised trade names of this sort, coined words which only the originator has the right to use.

Among farmers most advertising is done by breeders of good stock. Poultrymen in particular use much selling literature. Trademarks and tradenames are employed more and more by these men; but a surprising thing is that few avail themselves of the registry privilege, the cost of which is so trifling. Sometimes deplorable consequences arise.

A Massachusetts breeder of White Leghorns coined, or thought he did, a name suggesting that his hens were great egg producers, and he applied this name to his stock and his farm, the latter an enterprise in which he had some $25,000 invested. The name through the owner's advertising, became well known in many parts of the country. Then it developed that a Middle West farm breeding another variety of chicken, and advertising on a much smaller scale, was also using this identical coined name—and had registered it at Washington. There was nothing for the Massachusetts man to do but abandon the name which was undoubtedly worth hundreds or perhaps even thousands of dollars to him. So if you have originated a unique and business-getting name for the products of your farm, or for the farm itself, register it. That is the safe thing to do, and the business-like thing.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14293) W. R. S. asks: As you undoubtedly are aware, the advantages that would accrue from a more efficient method of oxygen separation than known at present would be of incalculable value to our country in the present crisis. The most economical method now known is that of fractional distillation, but this is far from being cheap and convenient. As the atomic weight of oxygen is more than that of nitrogen which is the chief constituent of the air, I believe that the separation of oxygen can be effected by intense centrifugal force. A. The separation of nitrogen from the oxygen of the air by centrifugal force has been performed, but whether a commercial possibility we cannot say. At normal pressure and the freezing temperature, oxygen weighs .08922 pound per cubic foot, and nitrogen weighs .07812 pound per cubic foot. This is a very slight difference upon which the centrifugal force is to act to overcome the kinetic energy of diffusion. We have no data at hand of the experiments in this direction. The various modes of securing oxygen are well presented in an article in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1867

(14294) F. H. P. says: Could you kindly give me any information re converting garbage into fuel. I think you published something regarding this in your magazine some time ago. If you have nothing on this probably you could put me in touch where I could procure this information. A. The word garbage as used in your country (Canada), usually includes municipal refuse consisting of kitchen food refuse, household ashes, combustable rubbish, and manure. In Ottawa this was collected in one set of wagons, no separation being made of the various classes of refuse except that during the winter months part of the ashes were collected separately. Mixed refuse can be burned without additional fuel in a suitably designed furnace. The essential features of such a furnace are provision for charging regular quantities at regular intervals, drying the refuse in the furnace before stoking into the burning grates, retention of heat in the furnace, preventation of leakage of cold air into the furnace, high pressure forced draught, preheating of this forced draught by utilization of the heat generated. Such a furnace is called a Destructor. When it is desired to utilize the heat generated by the burning refuse the waste gasses are passed through high pressure boilers installed in the setting between the furnace and the chimney. The amount of evaporation in the boiler naturally depends on the character of the refuse and other variables. In common practice about 1½ pounds of steam at 100 pounds pressure can be generated per pound of refuse burned. This often runs up to 3 or 4 pounds evaporation. The commercial value of garbage as fuel is illustrated by the Destructor at Westmount, P. Q., where the high pressure steam generated by utilizing the waste heat from burning refuse is a large proportion of the steam used in the municipal electric light plant. The present Destructor at Ottawa generates considerable steam from refuse. This steam is used for plant purposes. In the new Destructor at Toronto the officials did not see fit to accept the proposal to install boilers to utilize the waste heat. They have, therefore, lost to the city the heat value of from 25 to 40 tons of coal per day, which in these times of labor scarcity and fuel shortage is an important item.

(14295) C. E. M. says: Will you kindly state through the columns of your paper whether it is possible for a mine not attached by cable or anchor to the bed of the ocean and not suspended by floats from the surface to float at any depth between the bed of the ocean and its surface? Will you also state whether it is possible for a submarine to remain suspended between the bed of the ocean and the surface if the submarine has no motion imparted to it by the propellers? If memory serves me, at the time of the "Titanic" disaster, when a great many newspapers proclaimed that "she didn't go to the bottom," your paper had an article stating in effect that, since water is practicaly incompressible and the specific gravity of water the same at the bottom of the ocean or at any depth as at the surface, a body that would disappear below the surface would go to the bottom. A. A floating mine was developed nine years ago which maintained a specified depth of submergence for a certain period and then sank. This was accomplished by hydrostatic control of an engine in the mine which was operated by compressed air. The mine was given a specific slightly greater than one and cast adrift in a tidal channel or harbor entrance. It would slowly sink until the hydrostatic control opened the air vaive when the engine would turn the propeller and cause it to rise. It would rise until the control closed the valve and the process would be repeated. In this way the mine would fluctuate through a distance of three or four feet. None of these are in use now as far as we are aware. No mine will float at a specified depth unless controlled by some force. A submarine if handled by experienced men, can remain within a foot or so of a specified depth by pumping in or out a very small quantity of water. The fluctuation will be very slow, but continuous. Water is practically noncompressible and its specific gravity is, therefore, the same for practically all depths. Consequently it is impossible for any object to float of itself at a certain depth.

(14296) W. O. asks: The primitive man lived an out-door life, constantly in close contact with Nature; he slept on leaves or rudely improvised beds. All animals practically do the same; the dog and in fact nearly all animals, if indisposed, usually seek the damp cool earth to curl up and sleep, especialy if they are inclined to be feverish. We are told that the heart to a certain extent generates electricity. As men became more civilized and adopted civilized methods, clothed himself in socks, shoes and clothing; lived in houses closely carpeted and at night further insulated himself by climbing into an insulated bed. If he is inclined to insomnia, he rolls and tosses; this tends to produce friction from his clothing and increased heart action and create additional frictional electricity in the system. The thought comes to me that an overplus of static might irritate the nervous system. •I know of some persons who have attached a wire to the water pipe with a handle held in the hand for awhile before going to sleep. They claim the current flows from the earth, establishing an equilibrium in the system. I claim that unless the supposed benefits derived are imaginary, the static flows from the body to the earth. Is there any instrument made sensitive enough to record such current; or has any investigation, to your knowledge, been made along this line; or could sufficient static be generated in the system, as afore described, to affect the nervous system, or produce restlessness; or is the effect of the grounded wire merely imaginary? A. We have no preconceived opinion upon the subject of your letter, and should neither affirm nor deny that electricity might flow out of a human body through a wire. We do not know any proof that the body generates electricity in the process of its vital activity. It may or may not do so. We are certainly inclined to the belief that any assistance in obtaining sleep by means of an electrode attached to a water pipe is due to a mental suggestion rather than to any physical effect by a discharge of a static charge in the body due to insulation from lying on a bed. The mental rest or unrest of the person who is wooing "tired nature's sweet restorer" has more to do with the success of the wooing, we believe, than a discharge wire.

(14297) F. W. D. asks: I would like to know the process of making iron permanently black. If at any time the process has been printed in your paper, will you kindly let me know the date and I will obtain a copy. A. We do not know any process which will make iron permanently black. Any such coating will wear through in time by use or rubbing. A sulphide of iron coating can be produced by boiling together, sulphur one part and oil of turpentine 10 parts. While boiling, spread over the iron with a fine brush, or pencil, as it is called: then heat in the flame of an alcohol lamp. The sulphur unites with the iron to form a brilliant black. This and several other modes of blackening iron are given in our Cyclopedia of Formulas, which we will send for $5.00 by mail postpaid in greater New York; elsewhere as per the zone rates.

(14298) W. K. D. asks: Please advise me if it is possible to remove the bottom of a bottle with an electric needle, removing the contents of the bottle, then replacing the piece which was cut out. A. We cannot pronounce upon the possibility of cutting the bottom from a bottle which is filled with some liquid with an electric needle, and removing the contents of the bottle. If this can be done the bottom can be sealed on again by a glass worker just as other pieces of glass are melted together in the making of the articles. If the needle has sufficient heat it will crack the glass as it is drawn along. We have never used the electric needle for this purpose, but have used a red hot iron, which will do the job very well. In any case a mark will have to be made by a file where the crack is to begin.

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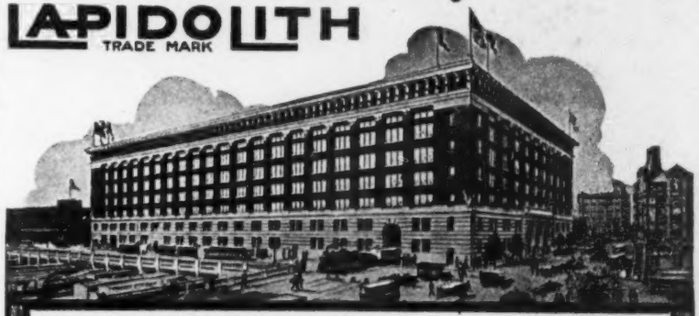

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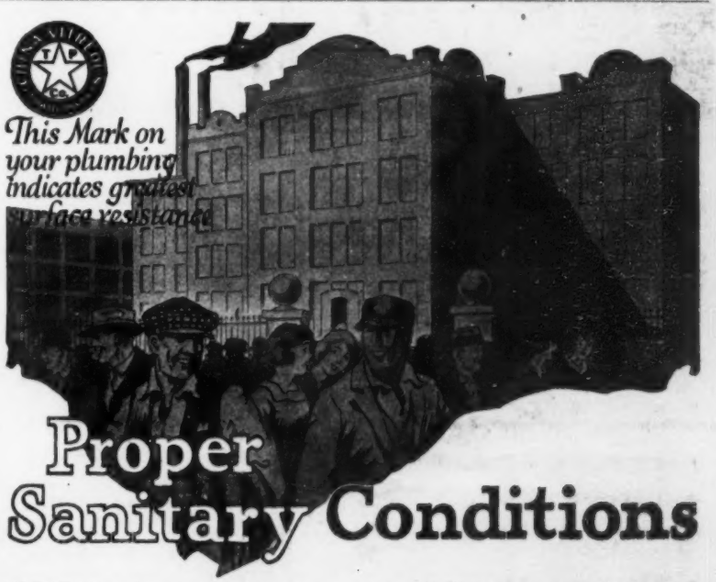

Proper Sanitary Conditions

SOUND judgment dictates that sanitary facilities are part of the shop equipment, and should be just as good, just as modern. The employee judges the whole by what meets his critical eye as the most unworthy part. His mental attitude is a direct reflection.

"Tepeco" Plumbing is sanitary, beautiful and permanent. Made of All-Clay products — the same as your dinner service. Years of experience have enabled us to perfect plumbing designs best suited to factory requirements. Every factory plumbing problem is different. Bring yours to us and secure competent advice. Send for our book "How to Increase the Margin of Profit on Your Employees by Industrial Sanitation."

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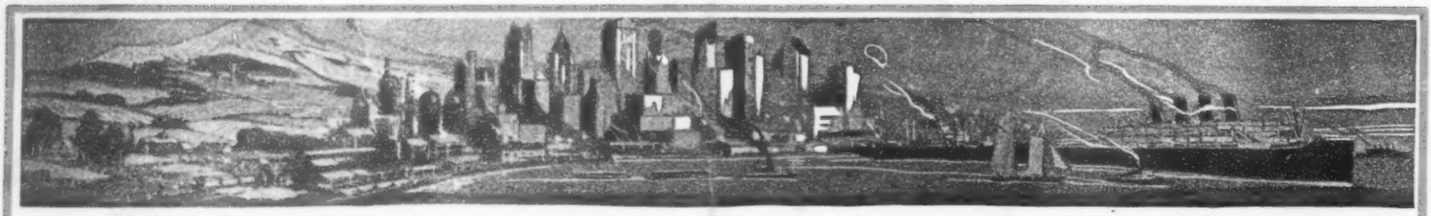


Getting Down to Business

Today American Business faces an era of stupendous possibilities. We are about to enter an age of industrial prosperity unmatched in history. The vast, unsuspected reservoirs of economic resources the war has tapped cannot be sealed up. They are known, open and flowing and must continue to flow for the benefit of all mankind. This is an obligation arising from the unquestioned Leadership in Finance, Transportation, Industry and Agriculture, which the fortunes of war have thrust upon America.

TO every thinking man, the future must be interpreted largely in terms of motor transportation.

New industries born of war's necessity must continue to serve in peace. They will need motor trucks.

The enlarged capacity of America's factories—none too great to meet our own and the world's requirements—must rely upon modern haulage.

Our standardized, fabricated ships are needed to carry America's goods to foreign lands. Their cargoes must "go down to the sea" in motor trucks.

The multiplied harvests of our power-operated farms can best be carried to market with motor trucks aiding railroad and ship.

Our soil is still rich with coal, ores, and petroleum. Better roads and more trucks are needed to release them.

We accept Federal's part in this great constructive peace period not only as an opportunity but as a *duty*.

That manufacturer falls short who sees in a motor truck only a power vehicle to be sold at a profit.

He must sense his larger obligation to supply haulage units that will assist in the fulfillment of America's great industrial destiny.

* * * *

FROM the very beginning of its history, Federal has laid solid foundations.

"Federal" signifies—not a mere combination of specifications—but performance—quality of service—the assurance of haulage, reliable, efficient and economical.

What Federal signified before the war, Federals have proved many times over in their war-time record.

That record is the ample evidence of what may be expected of Federal in the coming period of business expansion.

Federal plans for the future are plans for growth in order to answer every haulage need for more trucks and the right kind of trucks.

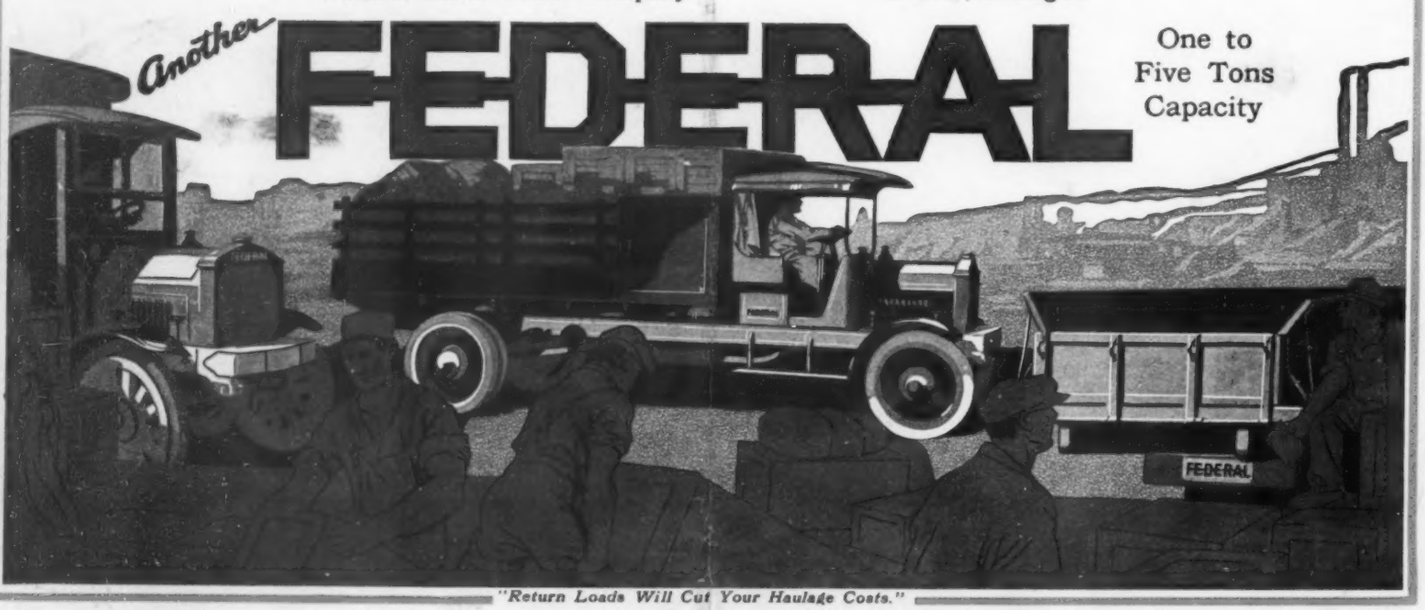
The Federal Haulage Research Department will be developed still further so as to offer motor truck users information that will enable them to get the utmost of service from their trucks.

This is the purpose that animates the entire Federal organization as we are once more "getting down to business."

If in the following out of this purpose, Federal can help you in your business, you may rest assured that no details will be overlooked in our endeavor to serve you well.

For the benefit of motor truck users, present and prospective, Federal publishes regularly an interesting worth-while magazine, "Federal Traffic News," which discusses actual problems of haulage in various specific lines of business and shows how they have been solved. It contains a wealth of suggestion on motor transportation for the owner and operator of trucks. We will be pleased to send it to business executives on request.

Federal Motor Truck Company **Detroit, Michigan**



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